SFWMD

Water Supply Contingency Plan

Attachment I --

Descriptions of Proposed Water Supply Options

October 10, 2000

South Florida Water Management District

Water Supply Division

Regional Water Management Options Considered

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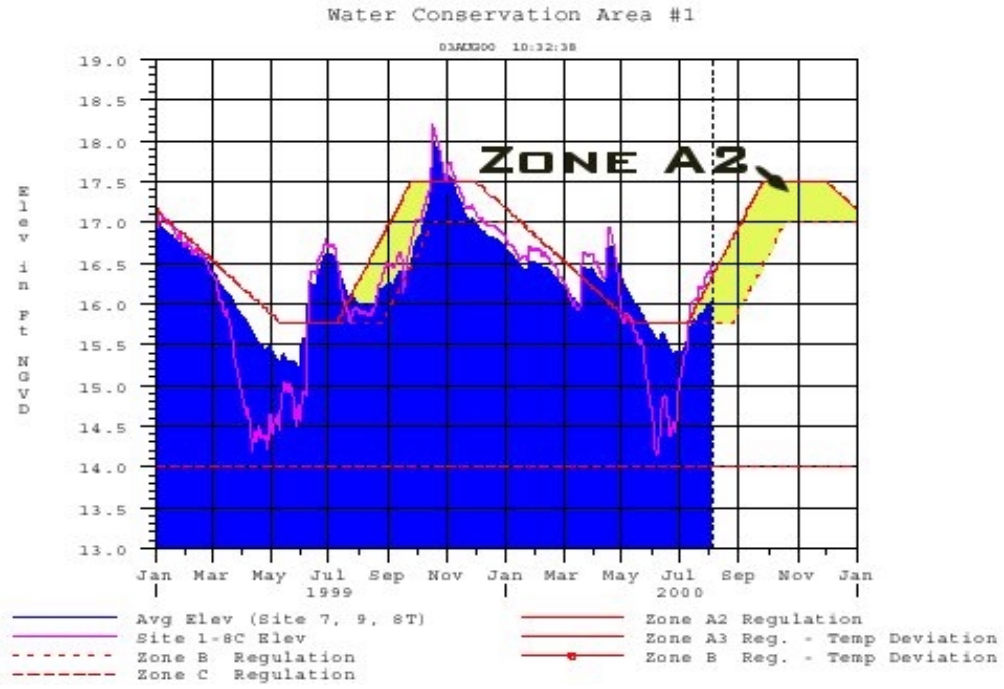
Regional Water Management Options Considered

Option #1. Move Water from WCA-1 Storage to Lake Okeechobee

Description -- Utilize Water Conservation Area 1 (WCA-1) for storage of Everglades Agricultural Area (EAA) runoff and regulatory releases of Lake Okeechobee water, as defined by the WSE regulation schedule for Lake Okeechobee and the regulation schedule for WCA-1 (**Figure I-1**). The volume considered available for storage would exist below the present WCA-1 regulation schedule and could be delivered to portions of the Lake Okeechobee and the Lower East Coast service areas directly from WCA-1. With completion of STA-1W, EAA runoff from the S-5 basin will be treated and could be held in WCA-1 until conditions are favorable to move excess water from WCA-1 into Lake Okeechobee for longer term regional storage. Excess water in WCA-1 would be defined as the available volume within the existing A2 Zone, above the present WCA-1 regulation schedule. Under normal operating parameters, water in Zone A would be discharged south to WCA-2A via the S-10 structures.

Figure I-1. Water Conservation Area 1 Regulation Schedule



If conditions are favorable, consideration will be given to either gravity or pumped conveyance of excess water available in WCA-1 to Lake Okeechobee. Two potential routes described below, could be used to move excess water from WCA-1 to Lake Okeechobee (**Figure I-2**):

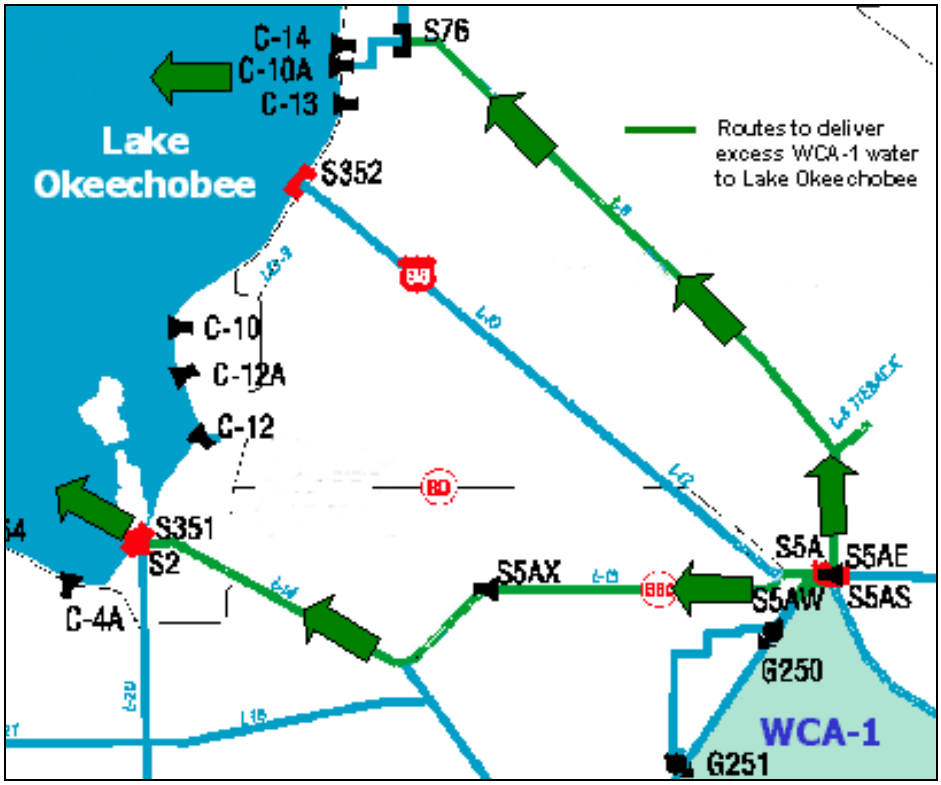
- **WCA-1 → S-5A(S) → L-8 → S-76 → Culv 10A → Lake Okeechobee**
- **WCA-1 → S-5A(S) → L-8 → S-5A(W) → L-13 → S-5A(X) → L-14 → S-2 → Lake Okeechobee**

The selection of the most appropriate route would be based on the time of year, severity of the projected water shortage, and the potential environmental impacts associated with the proposed route.

The L-8 route relies solely on gravity conveyance to Lake Okeechobee under normal operations. This route holds the most immediate promise for additional low nutrient water to Lake Okeechobee from WCA-1, as seepage from Corbett and Dupuis management areas, and/or as treated stormwater runoff from Indian Trail Water Control District. Other surface water discharges in the L-8 basin are fairly limited in capacity and potential water quality impact.

The L-13/L-14 route requires the use of the S-2 pumping station to convey water from WCA-1 to Lake Okeechobee. Because of the nutrient concentrations typically associated with EAA runoff, this operation may have a significant impact to the southern portions of the lake littoral zone if utilized early in the wet season and this operation would have to be reviewed beforehand by other agencies to determine water quality implications

Figure I-2. Proposed Routes to Deliver Water from WCA-1 to Lake Okeechobee.



Time Frame Considerations – The major operational elements of this option are immediately implementable as favorable conditions develop. The most appropriate time period for the implementation of this option would be during the wet season when highest probability for excess water in WCA-1 exists. Moving local L-8 basin runoff to Lake Okeechobee is facilitated under the present operating criteria and will occur as stages in L-8 rise above the stage in the lake. Documentation to request moving excess water from WCA-1 to Lake Okeechobee should be provided to the Florida Department of Environmental Protection, under the present Lake Okeechobee Operating Permit. The manipulation of water levels within WCA-1 associated with this proposal may have an impact on environmental conditions in the Arthur R. Marshall Loxahatchee National Wildlife Refuge managed by the U.S. Fish and Wildlife Service (USF&WS). Therefore, it will be necessary to immediately start discussions with the USACE, USF&WS and the FDEP to facilitate the potential implementation of this option.

Implementation Time – This option is facilitated through daily operation of the C&SF system under discretionary drought management protocols. Once the outstanding issues have been addressed with the USACE, USF&WS and FDEP, little preparation time is needed to facilitate gate or pump operations. It will take approximately one week to install temporary weed barriers on the downstream side of the G-300 structure in WCA-1. This option will provide the most potential to improve water supply for drought management if implemented during the wet season. The dry season value of this option for water supply is considered to be marginal. Likewise, the probability of environmental impact is higher in the wet season, due to the sensitive nature of the newly emerging littoral zone.

Implementation Components Coordination with the USACE regarding operational and water shortage issues may also be required. Regional hydrologic modeling using the South Florida Water Management Model (SFWMM) in the Position Analysis mode to compare alternative short term operating strategies may be required on a weekly basis

to assist the operational decision making process. Monitoring of ground water and surface water levels and water quality would be needed during the operation, most of which would already be happening under normal operating protocol (however faster data turnaround time would be necessary).

Responsibility – Water Supply Division for modeling and hydrologic assessment, Environmental Monitoring and Assessment Division for monitoring and water quality assessment; Operations Control Division for modified water control operations and coordination with the USACE. Cooperation from, and coordination with, local agricultural interests, Special Taxing Districts and utilities may be required to successfully implement this option.

Water Resource Benefits – Undetermined at this time. The benefits of this option are highly dependent on developing hydrologic, environmental and weather conditions. The spatial and temporal variability of rainfall will be a key element in the application of this option. However, if excess water becomes available in WCA-1 this wet season, it may be used as a source of water to either meet supplemental irrigation demands in the early dry season, or to move into regional storage in Lake Okeechobee for later use in meeting regional water supply demands. It must be recognized that even with very low stages in Lake Okeechobee, conveyance limitations through the EAA canal network may severely restrict the flow of water to the lake, even using available backpumping capacity at S-2.

Moving excess water from WCA-1 into Lake Okeechobee will have a significantly lower nutrient loading to the lake than is typically experienced with EAA runoff. Most inflows to WCA-1 should be provided some measure of treatment via STA-1W. Therefore, it is reasonable to expect significantly improved water quality in the discharges from WCA-1 to the lake.

Moving excess water from WCA-1 into Lake Okeechobee may reduce the potential discharge south into WCA-2A and 3A, thereby reducing the potential threat to the Cape Sable Seaside Sparrow and tree island habitat in the southern portions of WCA-3A.

Water Resource Impacts – The principle risk associated with this option is environmental impacts to WCA-1 and Lake Okeechobee from prolonged high water. Under extreme dry conditions, allowing consumptive water uses to depress water levels in WCA-1 below elevation 14.0 feet NGVD may also have impacts to the WCA-1 marsh habitat and wildlife populations managed by USFWS (see **Option 2**). However, these impacts may be mitigated by the fact that the proposed operations would be limited and implemented only through the 2000–2001 dry season. Moving water from WCA-1 to Lake Okeechobee in Zone A2 of the WCA-1 regulation schedule may reduce water available to the Lower East Coast for water supply. Therefore, it may be necessary to consider the proposed temporary deviation to the schedule allowing water supply deliveries to the Lower East Coast below the established minimum elevation of 14.0 feet NGVD

Water Use Benefits – Excess water that may become available in WCA-1 this wet season, may be used to either meet supplemental irrigation demands in the early dry season, or supplement regional storage in Lake Okeechobee.

Cost – Costs for implementation of this option above normal operating expenses would be limited to the installation of the temporary weed barrier and additional pumping that might be required if S-2 pumping station is used. This cost cannot be quantified until a better projection of available water can be developed through a regional hydrologic modeling simulation. Additional field crew time may be required to operate Culvert 10A if the L-8 route is used.

Conclusions

- If conditions are favorable, consideration will be given to gravity or pumped conveyance of excess water from WCA-1 to Lake Okeechobee. Selection of the most appropriate method/route would be based on the time of year, severity of the projected shortage, and potential environmental impacts.
- Once outstanding issues have been addressed among agencies, it will take approximately one week to install temporary weed barriers on the downstream side of the G-300 structure in WCA-1.
- The most appropriate time period for the implementation of this option would be during the wet season when highest probability for excess water in WCA-1 exists.
- Discussions with the USACE, USF&WS and the FDEP should be started immediately to facilitate implementation of this option.

- Regional hydrologic modeling in the Position Analysis mode may be required on a weekly basis to assist the operational decision making process. Monitoring of ground water and surface water levels and water quality would be needed during the operation.
- The benefits of this option are highly dependent on developing hydrologic, environmental and climatological conditions. The spatial and temporal variability of rainfall will be a key element in the application of this option.
- The principle risk associated with this option is environmental impacts to WCA-1 and Lake Okeechobee from prolonged high water.

Option #2. Allow Deviation from the Water Conservation Area 1 Schedule

Description – Consideration may also be given to requesting the USACE implement a temporary deviation to the WCA-1 schedule if water levels in WCA-1 fall below elevation 14.0 feet NGVD. Such a deviation could be conditioned to allow water supply releases to the Lower East Coast until WCA-1 (L-40 borrow canal) stages fell to 11.0 feet NGVD.

Time Frame Considerations – The manipulation of water levels within WCA-1 associated with this proposal may have an impact on environmental conditions in the Arthur R. Marshall Loxahatchee National Wildlife Refuge managed by the U.S. Fish and Wildlife Service (USF&WS). Therefore, it will be necessary to immediately start discussions with the USACE, USF&WS and the FDEP to facilitate the potential implementation of this option.

Implementation Time – Such a temporary deviation would most effectively be implemented during the dry season, once concerned parties have reached agreement.

Responsibility – Operations Control Division for modified water control operations and coordination with USACE.

Water Resource Benefits – None determined.

Water Resource Impacts – Potential to impact fisheries and vegetation communities in WCA-1, potential violation of MFL criteria, and potential to increase the incidence of wildfires in WCA-1.

Water Use Benefits -- reduced frequency and duration of water shortage declarations.

Cost -- Costs for implementation of this option above normal operating expenses would be negligible.

Conclusions

- A temporary deviation to the WCA-1 schedule to allow water levels to fall below elevation 14.0 feet NGVD that could allow water supply releases to the LEC until WCA-1 stages fell below 11.0 ft.
- Once the concerned interests agree that this option is desired, it could be implemented almost immediately.
- This option will reduce the incidence and severity of water shortage declarations in the LEC but may have substantial environmental impacts in WCA-1.

Option #3. Investigate Feasibility of Using Temporary Pumps and Structures

Description – Consider options for installation and operation of temporary pumps and structures to distribute water more effectively in the regional system and to meet local needs in problem areas. Inventory available WMD pumps. Identify vendors for leased pumps and structures, including prices and capacities. Identify pump and water level constraints relative to intake elevations and gravity structure constraints relative to invert elevations for recharging District's major canals from Lake Okeechobee. Optimize water levels in regional canals by using bladder bags or other temporary structures/plugs to facilitate water withdrawals during low flow and level conditions. A representative list of vendors and prices for temporary pumps is provided in **Table I-1.**

Time Frame Considerations – Facilities can be obtained upon notice to deliver. Permits may be required. The DEP and the Corps would have to be notified prior to installation.

Implementation Time – Pumps require 24 to 48 hours to install, depending on required site prep. Note: The District owns five 42" hydraulic pumps. Each pump can take up to one week to install, depending on site conditions. Temporary structures could be most easily installed during the dry season. Temporary structures in the form of bladder bags can be installed in a day by a six to eight man crew. They are readily available from the manufacturer, as long as the dam height required is under 8 feet. If a taller dam is required, the lead time increases to 2-6 weeks.

Implementation Components – Installation of temporary pumps requires commitment of funding, obligation of staff to set-up and perform continuous operation, and coordination of rental pump vendor. Structures require a site evaluation to determine what size dam could be used. Bladder bags would have to be purchased. One such product is the Aqua Dam, sold by the Water Structures company (information available at www.waterstructure.com). The installation would then be coordinated with the appropriate field station.

Table I-1. Availability of Pumps from Selected Commercial Vendors

Pump Types (applications and estimated rental prices -- average ($/month) among vendors)	**Pump Vendors and Sizes Available**		
	MWI PUMPS John Springer, 954-427-2206 Head size, Quantity, GPM	**HOLLAND PUMPS** Eldon Kerns, 561-697-3333 Head size, Quantity, GPM	**SLOAN PUMPS** Bill Shackleton, 954-581-2810 Head size, Quantity, GPM
TRASH PUMPS Applications: 1) Muddy water 2) Weeds 3) Trash 4) Sticks 5) Rags 6) Sewage 7) Sand **8)** Solids	6" - 60 each 1,700 gpm @ 55' 6" - 10 each (sump style) 1,800 gpm @ 165'	24" - 2 each 13,000 @ 40' head 18" - 4 each 7,200 gpm @ 20' head 14" - 12 each 7,000 gpm @ 20' head 12" - 24 each 5,000 gpm @ 20' head 8" - 25 each 2,500 gpm @ 20' head 6" - 67 each 1,500 gpm @ 20' head 4" - 27 each 800 gpm @ 20' head	24" - 3 to 4 each 13,000 gpm @ 40' head 18" - 3 to 4 each 7,000 gpm @ 30' head 12" - 3 to 4 each 4,000 gpm @ 40' head 10" - 3 to 4 each 3,600 gpm @ 40' head 8" - 3 to 4 each 2,800 gpm @ 40' head 4" - 3 to 4 each 550 gpm @ 20' head
Pump Head 24" 5,000 / month 18" 3,500 / month 12" 3,000 / month 10" 3,000 / month 8" 2,500 / month 4" 1,500 / month			
Suction & Discharge Pipe 42" $15.00 / linear foot 30" 9.00 / linear foot 24" 7.75 / linear foot 18" 7.25 / linear foot 16" 4.50 / linear foot 12" 5.50 / linear foot 8" 2.25 / linear foot			

Note: additional, general information from Sloan and Holland vendors available on request.

Table I-1. Availability of Pumps from Selected Commercial Vendors (Continued).

Pump Types (applications and estimated rental prices -- average ($/month) among vendors)	**Pump Vendors and Sizes Available**		
	MWI PUMPS John Springer, 954-427-2206 Head size, Quantity, GPM	**HOLLAND PUMPS** Eldon Kerns, 561-697-3333 Head size, Quantity, GPM	**SLOAN PUMPS** Bill Shackleton, 954-581-2810 Head size, Quantity, GPM
AXIAL PUMPS Applications: 1. Irrigation 2. Water supply 3. Dewatering 4. Non-abrasives 5. Sewage Pump Head $/Month 60" $15,000 / month 42" 14,400 / month 30" 7,500 / month 24" 5,500 / month 20" 5,000 / month 18" 4,500 / month 16" 4,000 / month 12" 3,000 / month 10" 3,000 / month 8" 1,800 / month 4" 1,500 / month	60" - 1 each 100,000 gpm @16' head 42" - 9 each (3-blade) 42,000 gpm @ 12' head (pumps are stackable) 42" - 1 each (5-blade) 45,000 gpm @ 17' 30" - 6 each (bre gear) 25,000 gpm @20' head (electric or diesel driven) 30" - 5 each (hac) 25,000 gpm @ 13' head (electric or diesel driven) 24" - 15 each 15,000 gpm @ 20' head 20" - 6 each 8,500 gpm @ 15' head 18" - 10 each (5-blade) 8,500 gpm @ 42' 16" - 4 each 7,500 gpm @ 25'	30" - ___ each 20,000 gpm @ 8' head	24" - 3 to 4 each 15,000 gpm @ 15' head 18" - 3 to 4 each 9,000 gpm @ 15' head 12" - 3 to 4 each 4,300 gpm @ 15' head 8" - 3 to 4 each 1,400 gpm @ 15' head
AXIAL PUMPS (Continued) Suction & Discharge Pipe 42" $15.00 / linear foot 30" 9.00 / linear foot 24" 7.75 / linear foot 18" 7.25 / linear foot 16" 4.50 / linear foot 12" 5.50 / linear foot 8" 2.25 / linear foot	12" - 20 each (HAC)4,000 gpm @ 20' 12" - 19 each (5-blade) 4,200 gpm @ 56' 12" - 10 each (#12, centrifugal) 5,200 gpm @ 50' 10" - 15 each 3,500 gpm @ 110' head 8" - 20 each 2,200 gpm @ 60' head		
MIXED FLOW (comb. centrifugal and axial) Applications: • Irrigation • Water supply • Dewatering • Non-abrasives Pump Head $/Month 24" $6,750 / month 20" 6,400 / month 16" 4,500 / month (use same pipe listed under axial pump)	24" - 2 each 12,000 @ 45' 20" - 2 each 8,500 @ 40' 16" - 3 each 6,500 @ 50'		

Note: additional, general information from Sloan and Holland vendors available on request.

Responsibility – The engineering group could perform the necessary analyses to determine size of facilities, procurement would oversee acquisition and crews from field stations would do the installation.

Water Resource Benefits – Water can be moved more effectively to drought-affected areas and operational flexibility is improved. Facilities can be quickly and easily installed and removed and use of temporary structures may minimize long term impacts to the system.

Water Resource Impacts – Depleting existing water storage may be an issue. Temporary facilities might prove vulnerable to vandalism or washout

Water Use Benefits – Increased ability to meet short-term water requirements at specific locations.

Cost – FTE impacts depend on number of pumps deployed. Pricing of pumps includes up to $500 per day operations costs for each District owned 42" pump. Rental pump vendor pricing depends on pump size, flow capacity, distance, and types (see attached Table I-1). Temporary dams under 8 feet in height cost approximately $100 per linear foot. For taller dams, the cost would increase to approximately $200 per linear foot for a 10-foot high dam to $400 per linear foot for an 18-foot high dam. The labor required would be approximately a six-man crew for eight hours. The dams are guaranteed against UV damage for one year. The dam would have to be evaluated at the end of that time to make sure it was still needed and structurally sound.

Conclusions –

- Portable/temporary pumps and structures provide a cost-effective, and rapidly deployable means to redistribute water. Permitting requirements are site-specific. Coordination with other agencies would be required at a minimum.
- The District has a relatively limited number of portable pumps, which can take up to one week to install, depending on site conditions. The cost per day for operations is $500. A variety of pumps can be rented or leased on short notice from local vendors and deployed within 24 to 48 hours (depends on required site prep) as needed during dry periods. Costs of pumps vary based on size, flow capacity, distance, and type.
- Temporary dams (bladder bags) can be installed in a day by a six to eight man crew and are readily available from the manufacturer for dam heights under 8 feet. Taller dams may required lead times of 2-6 weeks. Dams under 8 feet in height cost approximately $100 per linear foot; a 10-foot dam costs $200 and an 18-foot high dam costs $400 per linear foot.
- Temporary pumps and dams can be quickly and easily installed and removed. The primary benefit is the ability to move water to specific drought-affected areas. Impacts may occur by depleting existing water storage. Temporary facilities might prove vulnerable to vandalism or washout.
- An operational protocol is needed beforehand to determine where, when and what size facilities may be required; estimates of requirements for funding and support staff are needed; and detailed evaluation of site conditions would be needed to determine exact location and deployment of facilities.

Option #4. Kissimmee Chain of Lakes Operational Flexibility

Description -- Two aspects of this option were considered as follows:

- *Discretionary Lake Releases*: Implement a discretionary release protocol to provide flows from the Kissimmee Upper Chain of Lakes to Lake Okeechobee. These discharges from S-65 will occur even if Lake Kissimmee is below its regulation schedule. Discharge rates will be determined by Lake Kissimmee stage (below regulation schedule). The proposed release rate schedule is provided in **Figure I-3**.
- *Lake Gentry Drawdown: An* extreme drawdown for Lake Gentry is scheduled to commence during the fall of 2000. This water can be routed through the Kissimmee Valley to Lake Okeechobee, although the small lake size will have minimal downstream effect. The schedule for drawdowns in the Upper Kissimmee Chain of Lakes is shown in **Figure I-4**.

Time Frame Considerations – The intent of this release schedule is to provide additional flow south from Lake Kissimmee when the lake stage is below regulation schedule (large flow releases (2500+ cfs) occur when the lake is above regulation schedule. With this condition, implementation can occur regardless of wet/dry season.

Figure I-3. Lake Kissimmee Regulation Schedule

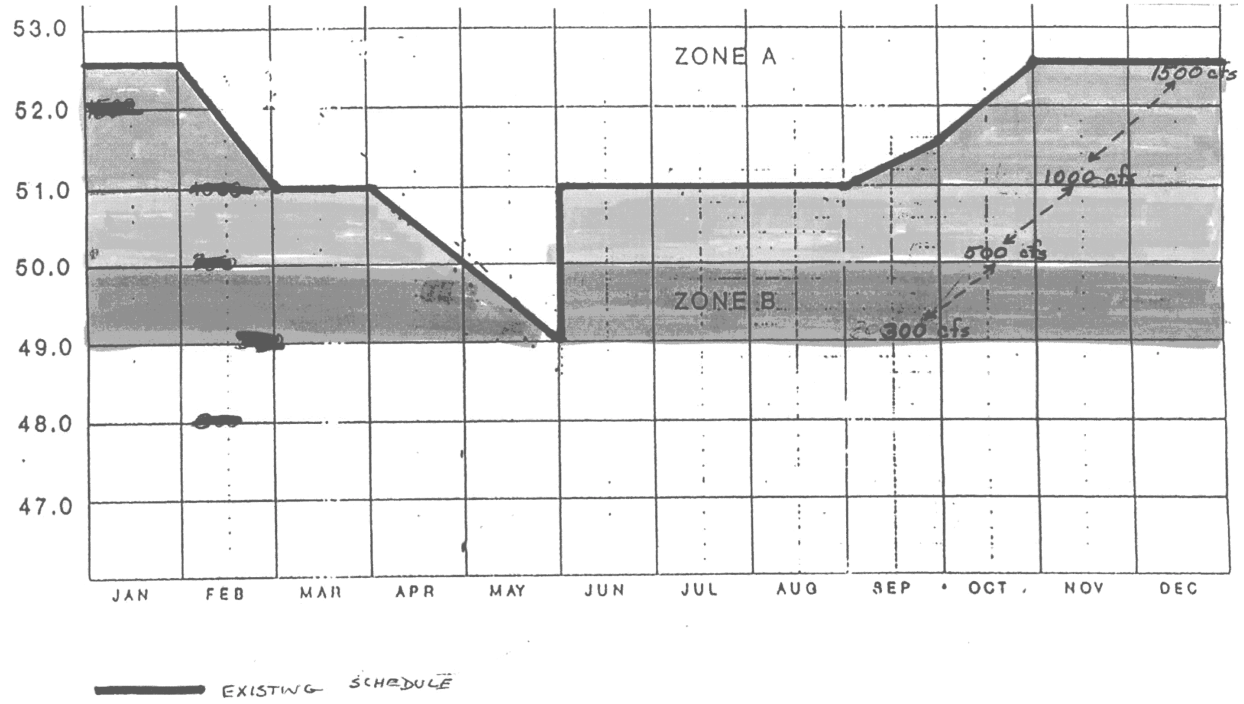
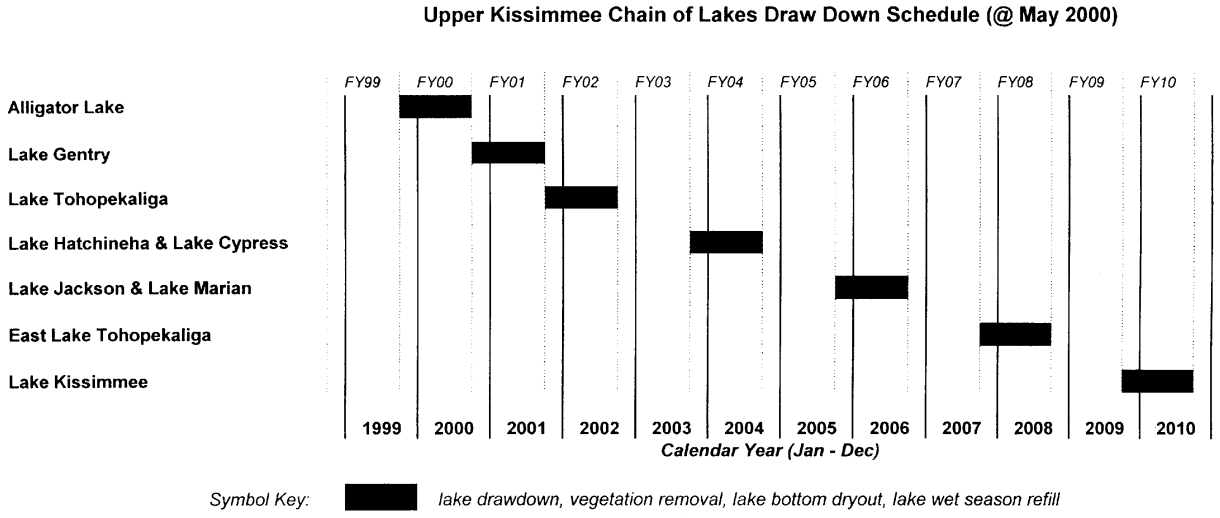


Figure I-4. Time Schedule for Implementing Kissimmee Lakes Drawdowns



Implementation Time – A version of a Lake Kissimmee position analysis spreadsheet model is currently being assembled That will allow for a forecasting examination of the potential effects of the discretionary releases on Lake Kissimmee stages. Implementation to gain operational experience could begin as early as this summer.

Implementation Components – Discussion has been held within the SFWMD (Operations & Watershed Research & Planning). In addition, initial concept introduction was conducted at the monthly SFWMD Interagency Kissimmee Lakes Steering Committee Meeting. Additional ongoing coordination with state and federal agencies should be conducted at the monthly steering committee meetings.

Responsibility – Operations will implement releases and the Kissimmee Department (WRP) will continually monitor release rate effects on lake stages and coordinate ongoing internal review with Okeechobee Department and Operations.

Water Resource Benefits – Potential benefits include additional waters delivered to Lake Okeechobee as well as reestablishment of continual base flows through the Kissimmee River.

Water Resource Impacts – Possible impacts may occur on water availability in Kissimmee Lakes' basins.

Water Use Benefits – Water use benefits include increased flows from the Upper Kissimmee Chain of Lakes to Lake Okeechobee. However, the magnitude will range from ~200 cfs to ~1500 cfs, depending on lake stages.

Cost – Implementation costs primarily involve SFWMD staff time. Additional SFWMD costs should be minimal.

Conclusions

- Two components were analyzed, to implement discretionary releases from the Kissimmee Upper Chain of Lakes and an extreme drawdown for Lake Gentry.
- This release schedule can provide additional flow south from Lake Kissimmee to provide additional 200 to 1500 cfs flow to Lake Okeechobee and continual base flows through the Kissimmee River. This option may reduce the amount of water available for use in upstream basins.
- Implementation to gain operational experience could begin as early as this summer.

Option #5. Water Conservation Area 2A Storage

Description – Under this option, it is assumed that the U.S. Army Corps of Engineers (USACE) will retain the existing, or a slightly modified version of, the temporary deviation to the Use Water Conservation Area No. 2A (WCA-2A) regulation schedule. This deviation allows higher stages in WCA-2A before regulatory discharges south to WCA-3A are required. Additional storage is thereby available to meet water supply demands in the dry season. Everglades Agricultural Area (EAA) runoff, and regulatory releases from WCA-1 and Lake Okeechobee, as defined by the WSE regulation schedule for Lake Okeechobee, can be provided to WCA-2A for storage. The volume considered available for water supply storage would exist below the WCA-2A regulation schedule and could be delivered to portions of the LEC Service Areas directly from WCA-2A under present operating criteria.

The deviation was originally required to comply with the Endangered Species Act under the Biological Opinion for the Cape Sable Seaside Sparrow. It is further assumed that the existing minimum elevation for regulating water supply withdrawals from WCA-2A will remain in place. However, depending on specific hydrologic and environmental conditions at the time water shortage plans are implemented, a deviation to the minimum threshold may be considered.

Time Frame Considerations – The major operational elements and necessary deviations to the schedule can be implemented are immediately, once the schedule deviation has been approved.

Implementation Time – This option is facilitated through daily operation of the C&SF system under discretionary drought management protocols. Little preparation time is needed.

Implementation Components – Regional hydrologic modeling using the South Florida Water Management Model (SFWMM) in the Position Analysis mode to compare alternative short term operating strategies may be required on a weekly basis to assist the operational decision making process. Monitoring of ground water and surface water levels and water quality would be needed during the operation, most of which would already be happening under normal operating protocol (however faster data turnaround time would be necessary).

Responsibility – Water Supply Division is responsible for modeling and hydrologic assessment, Environmental Monitoring and Assessment Division is responsible for monitoring and water quality assessment; Operations Control Division is responsible for modified water control operations and coordination with the USACE. Watershed Planning and Research Division and Office of Counsel are responsible for coordination with Florida Fish and Wildlife Conservation Commission (FFWCC). Cooperation from, and coordination with Broward County, local Special Taxing Districts and other utilities may be required to successfully implement this option.

Water Resource Benefits – Undetermined at this time. The benefits of this option are dependent on developing hydrologic, environmental and climatological conditions. The spatial and temporal variability of rainfall will be a key element in the application of this option. However, if excess water becomes available in WCA-2A this wet season, it may be used as a source of water to either meet Lower East Coast demands in the early dry season.

Water Resource Impacts – The principle risk associated with this option is environmental impacts to WCA-2A from prolonged high water.

Water Use Benefits – See discussion above.

Cost – No significant cost increase over normal operations is anticipated under this option.

Conclusions

- WCA-2A could be used to store EAA runoff, and regulatory releases from WCA-1 and Lake Okeechobee up to the regulation schedule. WCA-2 water would be delivered to the LEC area for water supply.
- This option could be implemented quickly, pending approval of the schedule deviation, completion of the modeling analyses and placement of monitoring systems.
- Benefits in terms of the amount of water provided are uncertain and this storage could have adverse environmental impacts to WCA-2A from prolonged high water.

Option #6. Cloud Seeding

Description – Use aircraft to disperse chemical agents into cloud formations to promote the formation of raindrops.

Time Frame Considerations – Based on the most favorable meteorological conditions, cloud seeding efforts should be undertaken during a 2-3 month favorable period of the rainy season.

Implementation Time – Assuming proper assessments of a Feasibility Study were performed and funds were available, implementation time could be from 1 to 2 months

Implementation Components – The following steps would be needed for implementation of this option:

- Initiate necessary steps for conducting a Feasibility Study.
- Conduct/initiate a Feasibility Study during the current rainy season.
- Based on results, staff would then determine the need for further action for this option.
- Initiate option.

Responsibility – An experienced contractor would have to be hired as determined by the Procurement Process and a District Project Manager to oversee the Project.

Water Resource Benefits – Cloud seeding can promote overall heavier rainfall with longer duration. Associated increases in cloud cover could also decrease evapotransporation.

Water Resource Impacts – Two primary impacts may occur as noted. These impacts could be balanced by sharing responsibility with the Federal Government.

- Public and political sentiment can sour quickly if any flooding or lightning deaths are perceived to have been caused by cloud seeding.
- Difficulty to obtain scientifically accepted results without expensive and potentially unnecessary multi-season seeding efforts.

Water Use Benefits – A couple of inches of water could be added to Lake Okeechobee heading into the dry season.

Cost – A 2 to 3 month program would cost approximately $1,000,000. Possible sharing of costs would be from the Federal Government and participating universities.

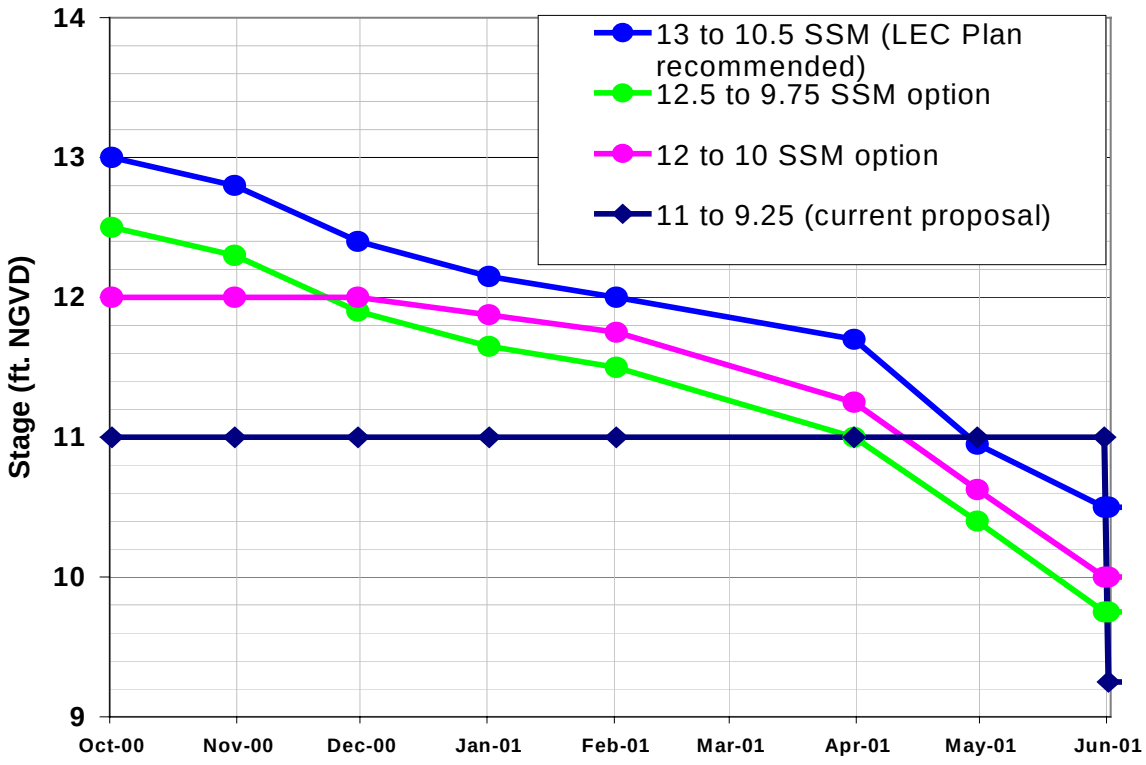
Conclusions

- Cloud seeding has proved effective in the past as a means to enhance rainfall, although the results are often unpredictable.
- Use of cloud seeding may be considered if sufficiently severe drought conditions are imminent.

Option #7. Develop and Implement a Modified Supply Side Management Plan

Description – Temporarily modify the current Lake Okeechobee Supply-Side Management (SSM) Plan (Hall, 1991) to make more water available without cutbacks to the Lake Okeechobee Service Area (LOSA). This option was also considered in the LEC Regional Water Supply Plan. According to the current plan, cutbacks are triggered in the dry season when the lake level falls below the Supply-Side Management (SSM) line which is the upper boundary of water shortage management zone A (Figure 4 of Hall, 1991). The LEC Plan proposed lowering of the SSM line by 0.5 feet. The net effect of this lowering is a reduction of the frequency and volume of water shortage cutbacks in LOSA. Other modifications to SSM have been evaluated by District staff. **Figure I-5** depicts those modifications to SSM that are currently under consideration. At this time, the District intends to operate under the 11.0 to 9.25 ft modified SSM Plan. SSM operations will continue to be evaluated and revised, if appropriate, based on current and proposed conditions.

Figure I- 5. Proposed Changes to Lake Okeechobee Supply-Side Management Plan..



Time Frame Considerations – Dry Season (October through May) only

Implementation Time – Implementation will occur throughout the dry season and actions will depend on lake levels during that period.

Implementation Components – As a part of Shared Adversity Plan, the Governing Board has already conceptually approved a proposed SSM change. The next step is to finalize details of the Modified SSM Plan, obtain additional approvals if necessary, and direct operations to implement the new policy.

Responsibility – Implementation by operations.

Water Resource Benefits – Slightly lower levels in the lake and associated littoral zone benefits.

Water Resource Impacts – According to the traditional Supply-Side Management Plan, one foot of lake water (for example approximately 327,000 acre-feet between 11' NGVD and 10' NGVD) is reserved for the purpose of preventing salt-water intrusion in the Lower East Coast wellfields through the Biscayne aquifer (Hall, 1991). With the lowering of the SSM line, there is concern that LEC demands may not be met fully from LOK when the lake levels below 10.0' NGVD. There is also a concern that modifications to SSM may result in low lake stages at the beginning of the next wet season and that if the next wet season rainfall is below normal, the water shortage could extend to the subsequent dry season.

Water Use Benefits – Decrease the frequency and volume of water shortage cutbacks that may be attributed to loss of storage in Lake Okeechobee. Lowering SSM attempts to offset the increased water shortage cutbacks due to possible lower lake levels at the beginning of the upcoming dry season (if the inflows during the remainder of the wet season are not large enough to raise the lake levels sufficiently).

Cost – No significant cost is expected.

Conclusions

- The current Supply Side Management (SSM) Plan can be modified to reduce the frequency and amount of water shortage cutbacks.
- Based on recommendations in the Lower East Coast Regional Water Supply Plan and as a part of a shared Adversity Plan, the Governing Board has previously considered a temporary SSM change.
- The next step is to finalize implementation details direct operations to implement the new policy throughout the dry season (October through May). Detailed actions taken will depend on the lake level during that period.
- The primary benefits will be reduced frequency and volume of water use cutbacks and littoral zone benefits due to slightly lower levels in the lake.
- The primary user impact is that if the drought persists and LEC urban users require water, the ability to convey water south from Lake Okeechobee may be limited when lake levels are below 10.0' NGVD.

Option #8. Cancel BMP Makeup Water Deliveries During Droughts

Description – This option recommends that the BMP replacement water from Lake Okeechobee be discontinued during the upcoming October through February release period, as long as the water level in Lake Okeechobee is in the warning zone or lower.

On October 12, 1995, the Governing Board adopted Part II, Chapter 40E-63, F.A.C. entitled, Everglades Water Supply and Hydroperiod Improvement and Restoration. The Subpart A of this statute is the BMP Replacement Water rule which includes (a) a model to quantify annual allocation of replacement water (40E-63.223); and (b) delivery of the annual allocation of replacement water (40E-63.225). The replacement water delivered from Lake Okeechobee to the Everglades Protection Area is calculated on October 1 every year. This amount is delivered during the subsequent 5-month "release period" from October through February. Included in the rule is an exception that allows the District staff to submit a replacement delivery schedule to the Governing Board for further consideration during extreme hydrologic conditions. One such extreme condition occurs when the water level in Lake Okeechobee is at warning stage or lower, as defined in the Lake Okeechobee Water Supply Management Plan.

Time Frame Considerations – Time needed to obtain the Governing Board approval for reconsideration of the replacement water delivery schedule.

Implementation Time – This option would be implemented during October through February, when the Lake Okeechobee water level is in the warning zone (Water Shortage Management Zone A) or lower.

Implementation Components – Governing Board approves for discontinuing replacement water delivery during the October, 2000 through February, 2001 period.

Responsibility –The Water Supply Division would request Governing Board action and the Operations Division would discontinue use of the replacement water release schedule.

Water Resource Benefits – Potential to help alleviate high water levels in Water Conservation Areas resulting from actions related to the Cape Sable seaside sparrow biological opinion.

Water Resource Impacts – If the Water Conservation Areas need additional water during the early dry season months, discontinuing replacement water delivery may not be desirable.

Water Use Benefits – Use of this option would allow more water to be stored in Lake Okeechobee during the early dry season months for minimizing potentially severe water shortages during late dry season months (April and May 2001). The average annual replacement water amount is approximately 160,000 ac-ft. Because of the reduced rainfall during the current year, the replacement water amount is expected to be less than this average.

Cost – A cost saving may occur due to a possible reduction in pumping

Conclusions

- Discontinuation of BMP makeup water deliveries allows more water (average of 160,000 ac-ft) to be stored in Lake Okeechobee during the early dry season months for minimizing potentially severe water shortages during late dry season months.
- If the Water Conservation Areas need additional water during the early dry season months, discontinuing replacement water delivery may not be desirable. Wetland impacts would then need to be balanced against the severity of the water shortage.
- This is an operational change that needs to be approved by the Governing Board.

Implementation of this option can save a substantial amount of water in regional storage at no cost.

Option #9. Modify Water Levels that are Used to Trigger Water Restrictions

Description – Improve existing monitoring networks and identify better water levels or saltwater intrusion criteria that are used as triggers to declare water restrictions for utilities and water users, especially those that are isolated from regional system.

Time Frame Considerations – Recommendations for improving water shortage monitoring networks and water shortage triggers should take place prior to the onset of the dry season and implementation of water shortage restrictions would be recommended during the dry season.

Implementation Time – Reaching a consensus on the trigger levels and could take several (2-4 weeks) of discussion. Implementation of water shortage restrictions based on these triggers is a fairly quick process (1-week). Water use restriction could last the entire dry season and beyond.

Implementation Components

- Identify needed improvements in monitoring networks
- Compile information on available hydrologic data.
- Convene meeting of internal staff to discuss factors for consideration.
- Convene a group of water users to discuss factors for consideration
- Develop consensus on individual subregional trigger levels for implementing and rescinding restrictions.

- Identify other considerations (time of year, use types, forecast, etc.)
- Convene Water Shortage team.
- Recommend implementing water shortage restrictions.
- Execute through Executive Director or Governing Board authority, as appropriate
- Notify all users in area.
- Convene compliance/enforcement workshops with local authorities.
- Administer water shortage program and monitor conditions.
- Rescind restrictions.

Responsibility – SFWMD would have primary responsibility. Local governments would have responsibility for compliance/enforcement.

Water Resource Benefits – Prevent serious harm to water resources – primarily in the form of saltwater intrusion. Serious harm is considered by the District as an impact that is irreversible or takes extremely long for reversal.

Water Resource Impacts – None

Water Use Benefits – Preserve the integrity of aquifer system for future use and promote more efficient use of available sources over the short run.

Cost – Costs to upgrade existing monitoring networks is moderate. The cost to SFWMD in staff resources to identify water shortage triggers is minor. SFWMD costs for administering the water shortage program once restrictions are implemented may be significant and may require allocation of significant staff at headquarters and Service Centers.

Phase I & II water restrictions have minimal cost impacts to the water use community. Perhaps the most significant cost would be a reduction in utility revenues. Phase III & IV water restrictions may have significant economic impact to the South Florida economy.

Conclusions

- Appropriate water levels and saltwater intrusion criteria need to be developed for declaring water restrictions for east coast utilities and water users.
- Agreement on new water shortage triggers could be reached within 4-6 weeks for implementation during the dry season.
- The primary benefit is protection of the resource by preventing serious harm to water resources – primarily in the form of saltwater intrusion. Phase I & II water restrictions are intended to have minimal cost impacts to the water use community.
- The most significant cost may be a reduction in utility revenues due to water use restrictions. Phase III & IV water restrictions may have significant economic impact to the South Florida economy.

Option #10. Expanded Water Shortage WEB Page

Description – Implement an expanded water shortage WEB page to inform the public of conditions/actions**.**

Time Frame Considerations – This task can be implemented at any point during the year when conditions warrant.

Implementation Time – Two days to two weeks depending on the level of modifications required and the priority assigned for obtaining support. Task could be ongoing and the workload is likely dependant upon lake stage and concern for water supply.

Implementation Components –Technical support for generating maps, graphs, and tables that would be posted to WEB page. A WEB gatekeeper for posting modifications.

Responsibility – Water Supply Division for page layout and content development, a WEB expert/gatekeeper for page layout and implementation.

Water Resource Benefits – Better and more timely information to the public and District staff.

Water resource Impacts – None apparent.

Water Use Benefits – Could possibly encourage water conservation and/or development of alternative supplies.

Cost –Cost would be minimal, primarily a relatively small impact on staff time. The District would assume the cost.

Conclusions:

- An expanded, continually-updated and well maintained web page can provide better quality and more timely information to the public and other agencies.
- This option may also help promote water conservation efforts.
- This page can be implemented at any time that conditions warrant, at relatively low cost.

Option #11. Reduce Maintenance Levels in LEC Coastal Canals

Description –This option consists of maintaining lower water levels upstream of salinity control structures as a means to reduce the amount of water that has to be released from regional storage into coastal canals to compensate for seepage losses to tide. This option allows existing resources to be used more efficiently while still protecting against saltwater intrusion. Lowering coastal stages for short periods of time, can save significant volumes of surface water in the regional system. This option focuses primarily on Miami-Dade County due to the high demands for regional water supply during droughts compared with northern service areas. Miami-Dade County also has significantly higher losses due to groundwater seepage around salinity control structures. Coordination of Miami-Dade County wellfield contingency options is also incorporated in this option. The wellfield contingencies include 1) increased use of ASR and 2) shifting some of the pumpage from coastal to western wellfields.

Time Frame Considerations – To ensure adequate protection against saltwater intrusion, canal stage management contingencies should be considered only under declared water shortage, during the dry season and for a duration on the order of four to six months. ASR contingencies should be initiated as soon as possible to increase the volume of stored water. Shifting of wellfield pumpage to the west should be implemented during the dry season.

Implementation Time – This option is achieved through daily operation of the C&SF Project system under discretionary drought management protocols. Little preparation time is needed. Miami-Dade County ASR contingencies are limited by DEP (no limited aquifer exemption issued). The ability to shift pumpage requires limited preparation time.

Implementation Components – Sensitivity modeling using the high resolution ground water models and/or the South Florida Water Management Model from the Lower East Coast Regional Water Supply Plan comparing impacts of 0.5' reduction in stages for varying duration. Monitoring of ground water and surface water levels and water quality would be needed during deployment, most of which would already be happening under normal operating protocol (however faster data turnaround time would be necessary).

Responsibility – Water Supply Division has responsibility for modeling and monitoring system design; Operations for modified water deliveries and Miami-Dade County wellfields. To maximize ASR storage, temporary increases may be needed from the West Wellfield, which would require authorization from Water Use and Executive Office.

Water Resource Benefits – Undetermined at this time, modeling to provide better estimate. During the evaluation of MFLs for the Biscayne aquifer in Miami-Dade County, modeling evaluations of stages at S-26, S-25B and S-22 were conducted. The evaluations revealed that lowering the upstream stage at these structures by 0.25' could save an average of 40,000 acre ft of regional water during a dry season. Wellfield contingencies would be needed to reduce risks of coastal saltwater intrusion.

Water Resource Impacts – The principle risk associated with this option is saltwater intrusion. During the 1990 drought, water supply deliveries to southern Miami-Dade were cutback in a similar manner as proposed here.

Review of this history would be helpful in assessing actual system performance and water savings on a small scale. Impacts of shifting the pumpage to the west involve potential dry season drawdowns under WCA-3A and ENP. The extent and duration of such drawdowns need to be carefully monitored to prevent harm

Water Use Benefits – See water savings discussion above.

Cost – Human costs are model run time, which would be minimized if existing models are used. Operation costs should be low because deliveries are by gravity. Miami-Dade County would potentially incur additional ASR pumping costs if they are allowed to operate the facilities at desired levels. Shifting of pumpage to the Northwest Wellfield causes increased color of finished water, which results in calls from the public to utility officials.

Conclusions

- Lowering maintenance stages in coastal canals for short periods during drought events can significantly reduce the amount of water lost from the regional system during droughts. Modeling evaluations indicate that lowering the upstream stage in LEC canals by 0.25' saved an average of 40,000 acre ft of regional water during a dry period.
- Wellfield contingencies, including increased use of ASR and shifting pumpage from coastal to western wellfields, if implemented, would reduce risks of coastal saltwater intrusion. The principle risk associated with this option is saltwater intrusion.
- Discussions with coastal utilities, coordination concerning reduction of canal stages, increased use of ASR and shifting pumpage should begin immediately. Additional modeling analyses should be conducted and monitoring systems should be developed, if water resource conditions warrant, so that this option can be effectively deployed when needed.

Option #12. Ch. 298 District Conservation Plans and System Improvements

Description – Some of these Districts operate both as drainage districts and as water supply/recharge districts through the manipulation of a secondary canal network, connected and operated under permit to the SFWMD's primary system. Optimization of canal stages within these districts could supplement and distribute recharge water under supply-side management to municipal wellfields during deficit rainfall periods. This option will involve discussions with drainage districts regarding their water conservation plans and required water shortage plans, as well as pump pad locations, available pumps and needs for culvert improvements. A major objective is to ensure that critical South Florida Water Management District culverts are properly set and maintained. The District will coordinate recharge to Lake Worth Drainage Districts when regional releases are being made and encourage LWDD to use C-51/Lake Osbome/Hillsboro connections when possible.

Time Frame Considerations – Storage capacities in the canals within these districts are limited, and these systems are operated primarily for drainage and flood control. Thus, optimizing these canals for distribution of water would primarily occur just prior to and throughout the dry season. The last condition survey done of the SFWMD project culverts was in 1994. At that time, there were 271 project culverts in the Okeechobee field station area alone. Many of those were in need of improvements, ranging from cleaning out the overgrown vegetation to replacement of the risers and/or culverts. Improvements have been made based on a priority rating system, with a few culverts added to the capital projects list each year.

Implementation Time – This option can be implemented quickly with the 298 Districts. Additional capacity gained through the concepts outlined under options 5, 6, and 12, would take more lead time as described in those options. Time needed for improvement of SFWMD culverts is very dependent on what type project culvert improvement is needed. It can range from a day for cleaning out vegetation to several months for replacing a culvert.

Implementation Components – The steps necessary for implementation would be:

1. Identify 298 and similar districts and status of their water conservation/emergency contingency plans
2. Inventory 298 District and SFWMD key culverts and their present status
3. Initiate dialogue with key 298 District staff

4. Compile necessary actions/costs to implement
5. Identify project leaders (Service Centers) to initiate/manage action plans

Responsibility – SFWMD project leaders and identified 298 district staff would be responsible for implementation. The South Florida Water Management District engineering group could perform the necessary field inspections. Depending on the level of effort involved, drainage district personnel, crews from the field stations or outside contractors would be able to perform the improvements.

Water Resource Impacts – Potential effects on water resources are all positive except when sporadic rainstorms might require the districts to shift into a drainage-oriented role. The timing of the improvements, especially if a culvert replacement is required, might make this option less effective. Identification of the specific project culverts in need of immediate improvements would also take considerable time.

Water Use Benefits – This option would improve the overall functionality of the system. Potential benefits would be amplified if combined with improved water conservation and water shortage planning in the 298 Districts.

Cost – The estimated human resource and monetary costs would be minimal except for additional costs developed in options 5, 6, and 12. Operational costs would be borne by the 298 Districts. Upgrade costs, developed under options 6, 6, and 12, could be supported by the District under emergency operations. Costs of SFWMD culvert improvements are very dependent on what type improvements are needed. The costs would range from a few hundred dollars for a field station crew to clean out vegetation to several tens of thousands of dollars if riser and/or culvert replacements are needed.

Conclusions

- Better management of water levels within these districts could supplement and better distribute water to agricultural consumers and recharge water to municipal wellfields.
- This option can be implemented quickly with the 298 Districts. The amount of water provided is limited. Additional capacity gained from implementing this option in combination with concepts outlined under other options would take more lead time.
- Potential impacts may occur if heavy rainfall occurs and the 298 Districts have to shift rapidly from water supply to drainage operations.
- To implement this option, status of facilities and contingency plans of the 298 Districts should be reviewed and a list of necessary actions and costs compiled during the wet season. Project leaders (Service Centers) would then be identified to initiate/manage action plans during the dry season.

Option #13. Implement the Brighton Seminole Indian Tribe Reservation Compact and Lower Istokpoga Basin Options

Description – The purpose of this option is to supply the Seminole Tribe's Brighton Reservation with water per Agreement C-4121 (shown at the end of this option analysis). This agreement establishes canal levels and quantities of water from Lake Okeechobee and Lake Istokpoga, by month, for delivery. The main outflow/inflow of water to the Brighton Reservation is through the C-40 and C-41 canals. The District supplies water to the reservation from Lake Istokpoga or by backpumping Lake Okeechobee water through G-207 and G-208 via these canals. The present Lake Istokpoga Regulation Schedule is shown in **Figure I-6** and historical volumes of water pumped through G-207 and G-208 facilities are shown in **Table I-2.**

Agreement C-4121 establishes the operational strategy for G-207 and G-208 in water shortage conditions. Generally, these pump stations provide water to the Brighton Reservation during declared water shortages. The Water Rights Compact provides the Tribe is entitled to 15% of the total amount of water which can be withdrawn from the District canals and from the District borrow canals by all users from the surface water within the Lake Istokpoga-Indian Prairie Basin. Lake Istokpoga water availability estimates for the Reservation are 26,872 acre-feet during the wet season (June through October) and 16,997 acre-feet during the dry season (November through May). In addition, the Tribe has access to a fractional share of surface waters from Lake Okeechobee. Agreement C-4121

establishes the means by which the District satisfies these requirements. Generally, canal levels and availability of water in Lake Istokpoga for supply purposes trigger operation of G-207 and G-208. The intake water level in the canals must be 10.0 feet or higher before the pumps can operate.

Related Projects – Lake Okeechobee has been identified in the 2000 Kissimmee Basin Water Supply Plan as the primary alternative water resource to Lake Istokpoga for the southern portion of this basin. This recommendation examines the utilization of existing pumps G-207 and G-208, and the installation of additional pumps at other structures to deliver water from Lake Okeechobee into the Lake Istokpoga-Indian Prairie Basin during periods when Lake Istokpoga is unable to meet water deliveries.

Another related effort is the evaluation and possible removal of the minimum flow requirements for G-207 and G-208. Chap 40E-22 requires monthly minimum discharges out of the Istokpoga Basin. An effort is underway to revise this requirement, which would make additional supplies available for all farms in the Istokpoga Basin. An estimated 37,000 ac-ft may be made available to the Istokpoga Basin (and lost from Lake Okeechobee storage) by removal of this requirement.

Time Frame Considerations – Specific criteria regarding entitled water deliveries to the reservation are included in Agreement C-4121. Criteria are established for the following conditions: 1) No declared water storage, 2) Declared water shortage in Lake Istokpoga, and 3) Declared water shortage in Lake Okeechobee. Based on the Lake Istokpoga stage level reported on July 25, 2000, the lake level is at 37.7 feet, which is extremely close to the water shortage declaration level.

Implementation Time – This option can be implemented based on criteria of Agreement C-4121. The G-207 and G-208 pumps are in place and operational,.

Implementation Components – All the facilities required to release water from Lake Istokpoga or Lake Okeechobee to the Brighton Reservation are operational.

Responsibility – Office of Counsel and Water Use Regulation are responsible for interpreting the compact agreement and developing operational protocols. Operations Department will implement this option, with assistance from other departments for field compliance efforts.

Water Resources Benefits – Pumping water from Lake Okeechobee using G-207 and G-208 to the Brighton Reservation Canal C-40 and C-41 will mitigate potential water shortages in the Lake Istokpoga-Indian Prairie basin.

Water Resource Impacts – Under the current Lake Istokpoga regulation schedule water shortages can be declared when Lake Istokpoga stages are below 38.0 feet in August, 39.0 feet in October and 38.5 feet in December (see attached regulation schedule); therefore, releases from Lake Istokpoga do not appear feasible. Navigation access to Lake Istokpoga is difficult below a stage of 37.0 feet. Using G-207 and G-208 may reduce storage in Lake Okeechobee if the required deliveries to the reservation are made. In addition, there are water quality impacts that may need to be quantified.

Water Use Benefits – The District will be capable of providing those water deliveries required by Agreement C-4121 to the Brighton Reservation. Depending on the timing and spatial distribution of the drought, using G-207 and G-208 can alleviate water conditions in Lake Istokpoga. During the period of June 1996 through May 1997 the District pumped 46,834 acre-feet of water from G-207 and G-208 to canals C-40 and C-41.

Cost –The estimated operation cost for two electrical pumps is $130/hr. Assuming that both pumps will be pumping an average of 8 hours per day, the estimated monthly operational cost is about $30,000 per month during the wet season months, and about $17,000/month during the dry season months in which the required water deliveries to the Brighton Reservation decrease.

Conclusions

- The Brighton Reservation can be effectively provided with water during droughts per Agreement C-4121. The District supplies water to the reservation from Lake Istokpoga or by backpumping Lake Okeechobee water through G-207 and G-208 via C-40 and C-41 canals.
- All the facilities required to release water from Lake Istokpoga or Lake Okeechobee to the Brighton Reservation are operational.

- Pumping water from Lake Okeechobee using G-207 and G-208 to the Brighton Reservation Canal C-40 and C-41 will help mitigate potential water shortages in the Lake Istokpoga-Indian Prairie basin.
- Using G-207 and G-208 will reduce storage in Lake Okeechobee by 0.1 foot if the required deliveries to the reservation are made.
- Depending on the timing and spatial distribution of the drought, using G-207 and G-208 can alleviate water conditions in Lake Istokpoga.

Figure I-6. Lake Istokpoga Regulation Schedule

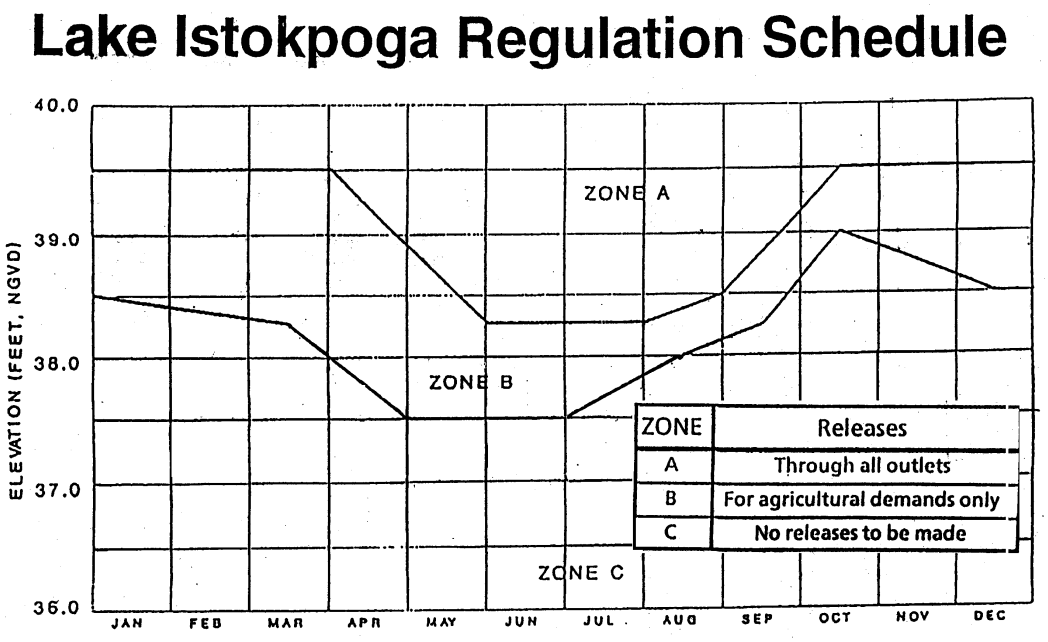


Table I-2. Water Pumped through G-207 and G-208, 1990-1999

Total Flows to C-40 and C-41				Flow at G-207 (acre-ft)			Flow at G-208 (acre-ft)		
W/D Year	G-207 (acre-ft)	G-208 (acre-ft)	Total pumping (acre-ft)	WET (Jun-Oct)	DRY (Nov-May)	TOTAL Dry & Wet	WET (Jun-Oct)	DRY (Nov-May)	TOTAL Dry & Wet
1990-91	5		5	5	0	5			
1991-92	95	0	95	0	95	95	0	0	0
1992-93	12094	1073	13167	245	11849	12094	0	1073	1073
1993-94	3122	4941	8063	887	2235	3122	1087	3854	4941
1994-95	37	42	79	9	28	37	7	35	42
1995-96	364	496	860	30	334	364	28	467	496
1996-97	15894	30940	46834	1640	14254	15894	3038	27902	30940
1997-98	232	204	436	33	199	232	34	170	204
1998-99	1944	5036	6980	291	1653	1944	308	4728	5036
Average				349	3405		500	4248	

AGREEMENT BETWEEN THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT AND THE SEMTNOLE TRIBE OF FLORIDA AND WATER SUPPLY PLAN FOR THE BRIGHTON RESERVATION IMPLEMENTING SECTION VI.B. OF THE WATER RIGHTS COMPACT ANT) SUBPARAGRAPH 3.3.3.2.A.3 OF THE CRITERIA MANUAL (AGREEMENT NO. C-4l21)

WHEREAS, the South Florida Water Management District (District) has entered into a Water Rights Compact (Compact) with the State of Florida and the Seminole Tribe of Florida (Tribe); and

WHEREAS, pursuant to Part VI., Section B of the Compact and subparagraph *3.3.3.2.A.3* of the Criteria Manual for the Compact, there is specific authority for the District to take actions to ensure that the Tribe receives the fifteen percent (15%) entitlement set forth in the Compact for the Brighton Reservation; and

WHEREAS, the District makes water supply releases from Lake Istokpoga to maintain the canals at or near optimum until such time as the level of Lake Istokpoga reaches the water supply minimum level as outlined in the regulation schedule for Lake Istokpoga, hereby attached and incorporated as Exhibit "A"; and

WHEREAS, historically, water shortages have' been declared for Lake Istokpoga and the Indian Prairie Basin when Lake Istokpoga reaches the water supply level as outlined in the regulation schedule and the canals reach the minimum levels established in Rule 40E-22.072, Florida Administrative Code, hereby attached and incorporated as Exhibit "B"; and

WHEREAS, the District issued a preliminary report in December, 1988, which concluded that, at times, the lower reaches of the Indian Prairie Basin canals traversing the Seminole Brighton Reservation did not get a fair share of the discharge from Lake Istokpoga and/or run-off generated and that, for various reasons the fifteen percent *(15%)* minimum entitlement was not always available to the Reservation; and

WHEREAS, the preliminary report also determined that implementation plans would be developed employing specific strategies to assure maximum reliability in delivering the Tribe's fifteen percent *(15%)* share to the Reservation; and

WHEREAS, the District installed pumps on the C-41 and C-40 canals at S-71 and S-72 respectively, to provide additional water supply from Lake Okeechobee.

NOW, THEREFORE, the District and the Tribe hereby agree, in order to provide the Tribe with its entitled share of surface water for the Brighton Reservation, to implement the provisions of section VI.B. of the Compact and subparagraph 3.3.3.2.A.3 of the Criteria Manual by the following method:

1. No Declared Water Shortage

The District agrees to maintain the water in the C-41 and C-40 canals south of S-70 and S-75 at optimum levels provided that neither Lake Istokpoga nor Lake Okeechobee are in declared water shortages. Optimum levels shall be 19.2 feet mean sea level (msl) in the segment of the C-41 canal between S-70 and S-71 and 20.2 feet msl in the segment of the C-40 canal between S-75 and S-72.

2. Declared Water Shortage in Lake Istokpoga

If Lake Istokpoga is in a declared water shortage and Lake Okeechobee is not in a declared shortage, the District agrees to maintain the water in the C-41 and C-40 canals south of S-70 and S-75 at optimum levels unless and until a shortage is declared for Lake Okeechobee. In order to accomplish this, when Lake Istokpoga is at or below the water supply level of the regulation schedule, the District agrees to operate the pumps at S-71 and S-72 on the C-41 and C-40 canals.

3. Declared Water Shortage in Lake Okeechobee

If Lake Okeechobee is in a declared water shortage, 'the District agrees to maintain the water in the C-41 and C-40 canals south of S-70 and S-75 at optimum levels through releases from Lake Istokpoga unless and until a shortage is declared for Lake Istokpoga or until Lake Istokpoga reaches the water supply level of the regulation schedule.

a. When sufficient water is not available in Lake Istokpoga to maintain water levels in these canals at optimum levels, the District agrees to operate the pumps at S-71 and S-72 on the C-41 and C-40 canals when Lake Okeechobee is at or above elevation 10 (ten) feet National Geodetic Vertical Datum (NGVD), or utilize available storage in District canals, to supply the minimum water amounts to which the Tribe is entitled under the Compact, as set forth in Table 7 of the December 1988 Technical Report entitled "A Technical Report on Water Availability Estimates for Brighton Reservation." Table 7 of this report is hereby attached and incorporated as Exhibit "C.'

b. The District shall use its best efforts to operate the pumps at S-71 and S-72 on the C-41 and C-40 canals when the level of Lake Okeechobee falls below 10 (ten) feet NGVD as long as mechanically possible without damaging the pumps, in order to provide the minimum amounts of water identified in Table 7 of the December 1988 Technical Report The District cannot guarantee that the pumps will operate if the level of Lake Okeechobee falls below 10 (ten) feet NGVD.

c. If in any given month the Tribe requests the District to withhold deliveries, in whole or in part, the District will not be responsible for delivery of the quantity of water withheld in a later month.

4. Reserved Lake Okeechobee Water

A sufficient volume of water from Lake Okeechobee, (See column 4 of Table 7 of the December 1988 Technical Report) shall be reserved and set aside in order to satisfy the District's obligations under section VI.B. of the Compact, as specified above in Sections 2 and 3 of this Agreement and Plan. This volume of water shall not be available for other users of water.

5. Education and Training

The District will provide Tribal representatives with appropriate training and education and necessary available data concerning the regulation schedules of both Lake Istokpoga and Lake Okeechobee.

6. Other Provisions

a. This Agreement and Plan may be modified with the consent of the parties, and shall be reviewed as operational data becomes available concerning the mechanical operations for the pumps when the elevation of Lake Okeechobee falls below 10 (ten) feet NGVD.

b. This Agreement and Plan is in full satisfaction of the District's obligations under subsections VI.B.l, 2 and 3 of the Compact and subsection 3.3.3.2 of the Manual.

c. The Tribe warrants that approval of this Agreement and Plan by the Seminole Tribal Council will bind the Tribe to its terms and will provide the District with an opinion of counsel to that effect or, at the option of the Tribe, to obtain any approval by federal authorities that may be necessary.

d. The District warrants that approval of this Agreement and Plan by the District's Governing Board will bind the District to its terms.

e. This Agreement shall commence on the date of execution and continue in full force and effect until such time as it is terminated by the parties by mutual written consent.

f This Agreement shall be subject to the procedures established pursuant to Section VII F and VIII of the Water Rights Compact with respect to disputes and court actions.

g. If it is subsequently determined by a federal court of competent jurisdiction that either of the approvals specified in subsections (c) and (d) of this section were not effective, then this Agreement and Plan shall be null and void.

Dated this 30th day of November, 1992.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT,
BY ITS GOVERNING BOARD

Legal Form Approved

By Thomas L. Wolfe

By: Alan Milstead
Chairman

SEMINOLE TRIBE OF FLORIDA

By:
Title: Chairman

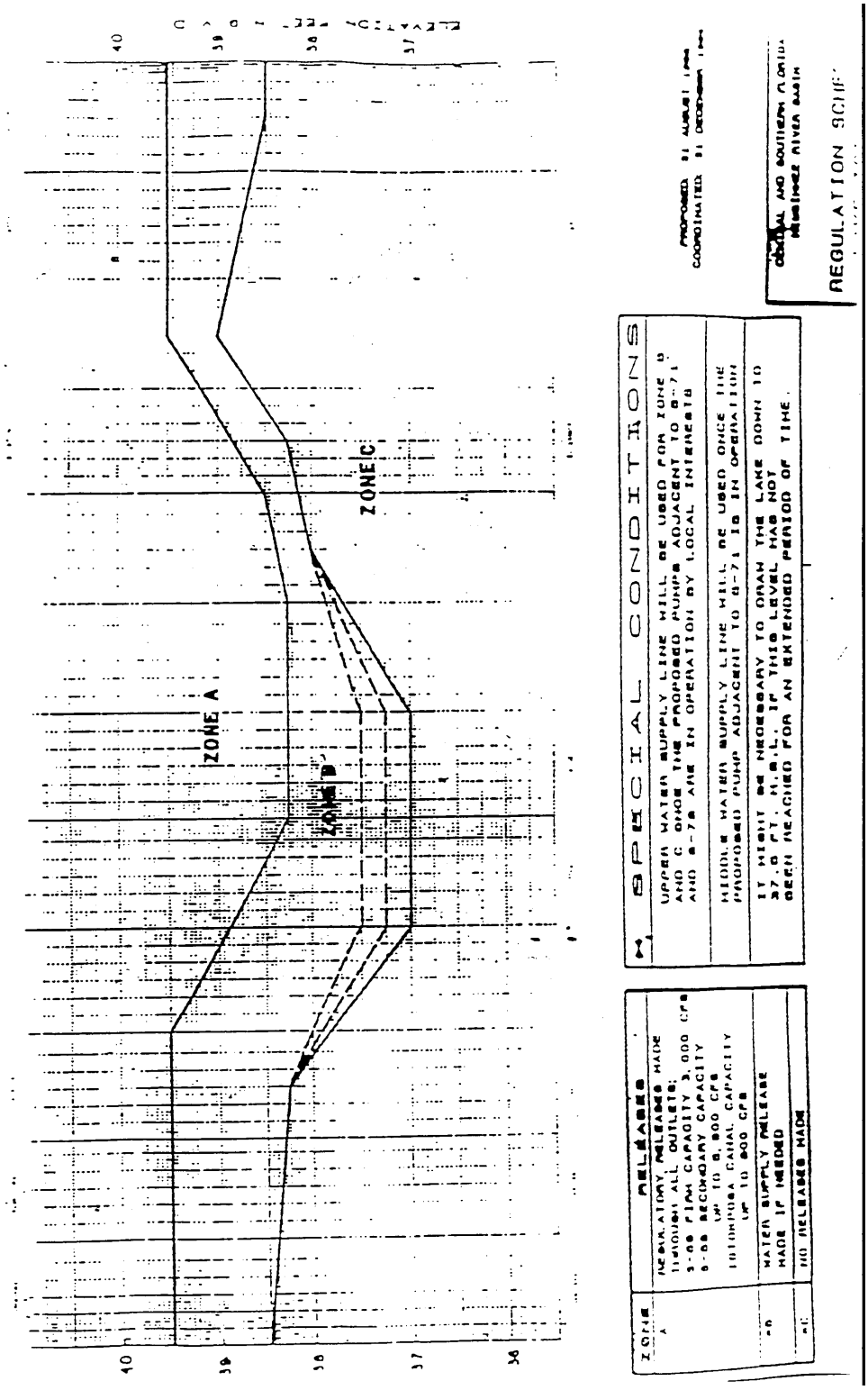

ZONE A
ZONE B
ZONE C
SPECIAL CONDITIONS
REGULATION SCHE
RELEASES
ZONE

Exhibit A

40E-22.072 Minimum Levels.

The following minimum levels shall be maintained.

(1) Lake Istokpoga

(a) The minimum levels for Lake Istokpoga are shown in Figure 22-2.

(b) The District may. after public notice, allow the minimum levels in Figure 22-2 to be temporarily lowered for environmental or water quality reasons.

(2) Primary Canals (feet above mean sea level)

CANAL		LEVEL
(a)	Canal 39-A above Structure 75	22.5
(b)	Canal 40 above Structure 72	17.7
(c)	Canal 41 above Structure 71	17.0
(d)	Canal 41 above Structure 70	22.5
(e)	Canal 41-A above Structure 84	21.7
(f)	Canal 41-A above Structures 82 and 83	29.0
(g)	Borrow Canal of Interceptor Levee 59	17.7
(h)	Borrow Canal of Interceptor Levee 60	17.7
(i)	Borrow Canal of Interceptor Levee 6	17.0

Specific Authority *373.044,373.113 FS.*
Law Implemented *373.042,373.086,373.103(4) F.S.*
History — New *9-3-81.*
Formerly *16K-30.03, 16K-30.05, 40E-21.072.*

Exhibit B

Table 7

Water Availability Estimates
(acre-feet)

Month	(1) Water Available in Lake lstokpoga	(2) Runoff Generated in the Basin	(3) Water Available to the basin (1)+ (2)	(4) Presumptive Water Availability for the Reservation 15% of(3)
January	10,148	2,002	12,150	1,823
February	10,856	2,498	13,354	2,003
March	22,369	3,583	25,952	3,893
April	17,801	1,755	19,556	2,933
May	15,4.47	5,352	20,799	3,120
June	17,180	21,090	38,270	5,741
July	19,859	19,950	39,809	5,971
August	22,909	16,950	39,859	5,979
September	19,475	17,250	36,725	5,509
October	15,717	8,760	24,477	3,672
November	10,4.82	1,927	12,490	1,861
December	7,109	1,983	9,092	1,364

Exhibit C

3.3.3.2 Special Provisions Applicable to Specified Reservation and Tribal Trust Lands.

A. Brighton Reservation --

1. The District shall determine, to the degree possible, whether the Tribe is getting its share of surface water, as specified in the Compact from the District canals and from District borrow canals calculated by the District on a monthly basis, and shall take the necessary steps to provide solutions to the water supply problems.

The District shall:

i. Examine operational criteria for District structures in the Indian Prairie Basin to balance the available surface water in the northern and southern areas of the system;

ii. To the extent feasible, seek to eliminate structural bypasses in the Indian Prairie Basin and uses of Indian Prairie Basin water by those outside the basin by substituting an alternate source for such uses; and

iii. Cooperate with the Tribe to identify functional problems within the Tribe's internal water supply system.

3-12

Exhibit D

Option #14. C-139 Basin Storage Options

Description – The concept behind this option is to determine the feasibility of increasing local storage within the Big Cypress Reservation, for use as irrigation water thereby reducing and delaying the demands for supplemental water from the regional system. This concept involves the use of the newly deployed G-409 pump station to deliver wet season flows on tribal lands for storage. This stored water would be used for irrigation at the beginning of the dry season, instead of water from the Miami Canal pursuant to the Seminole Entitlement Agreement.

Investigation into this option has revealed that it is not feasible at this time due to at least two factors. The first is related to legal constraints related to water availability within the basin and monthly limits on the volumes of water available to the Tribe. The second deals with the fact that the Tribe has not yet completed construction of their storage reservoirs at this time. Therefore, this option should be considered for use during future droughts after these issues are resolved.

Time Frame Considerations –This option would be deployed during the wet season.

Implementation Time – (not determined)

Implementation Components – Resolve remaining legal issues; complete construction of reservoir facilities; develop an appropriate protocol for operation of G-409 pump station,

Responsibility – (not determined)

Water Resource Benefits – (not determined)

Water Resource Impacts – (not determined)

Water Use Benefits – (not determined)

Cost – (not determined)

Conclusions

- This option is not feasible at this time due to legal constraints and lack of facilities, but may be considered for future implementation

Option #15. Broward County Modification of Supply

Introduction

This option has been divided into three general goals (North, Central, and South County), and 11 strategies. Four of the strategies involve secondary canal integration through independent or dependent drainage/water control districts and thus should be considered in concert with **Option 7,** Conservation and Culvert Improvement Options for 298 Districts

North County: Shift Supply to North County Wellfield and/or Coastal Area

Description -- Using Hillsboro Canal, recharge as much water as possible to North County Regional Wellfield, and/or to coastal areas, thus minimizing cutbacks from wellfield production. This option includes the following actions:

1. Engage new diversion pumps on Hillsboro Canal to supply water to County's C-5 and C-3 Canals, then to N. Regional wellfield through Cocomar interconnections. However, this must be synchronized with the interconnection/pump on the C-2 canal, as follows:
2. Using County's existing pump on C-2, and using the C-1 and C-2 canal loop, provide recharge to coastal area to inhibit saltwater intrusion.
3. Supplant some Biscayne Aquifer well production at County's 2A facility by using ASR well. Explore conversion of ASR well to a Floridan production well. Would need to overcome permitting issues (FDEP, WMD, Health Dept.), and examine chloride threshold for blending.

4. Install appropriate water control structure on County's C-3 canal just north of interconnection/outflow with C-14 Canal. Objective is to hold water higher in C-3 in order to promote groundwater recharge to benefit Pompano Beach's Palm Aire wellfield.

With the consent of both Broward County and Pompano Beach utility, explore supplying finished or raw water from the County's North Regional System to the Pompano Beach system, especially if it will help solve the city's blending concerns.

Implementation Time (Readiness) -- C-5 Pump is now in final testing stages, and will be operational in advance of dry season. C-3 Pump will not completed by dry season, however other structural alterations or temporary pump should be investigated. ASR well is operational, however permit conditions restrict its use. Supply from County to Pompano Beach will require intergovernmental agreement.

Implementation Components: Quiet pumps (possibly electric) or other conveyance means will have to be on line to deliver water. ASR well will have to be operated to reach desired targets. The Florida Department of Environmental Protection would need to consent to operational flexibility to allow flexibility of use of the ASR well.

Responsibility: District has or is providing financial assistance to the county to develop facilities. Broward County is responsible for operating its system, while Pompano Beach operates its system. Cooperation from local utilities (Pompano Beach, Deerfield Beach, Hillsboro Beach will) be necessary.

Water Resource Benefits: This option protects against saltwater intrusion, while minimizing coastal utility cutbacks. Benefits accrue to the following water utilities: Deerfield Beach, County's 2A wellfield, Hillsboro Beach. If C-3 is successfully held at higher stage, this will also benefit Pompano Beach.

Water Resource Impacts: By emphasizing supply to more coastal areas, Some reduction in ground water levels in northwestern Broward County could occur. Maintaining ground water levels toward coast will help protect against saltwater intrusion.

Water use Benefits: described above

Cost: A cost share between the county and District is already being implemented, and funds are encumbered. The District's share of the pump construction is $349,000. The District's contribution to the construction of the ASR well was $1.55 million. Other costs have been and will be borne by Broward County., and the coastal utilities.

Central County: Increase Recharge to Ft. Lauderdale Prospect and Dixie Wellfields

Description – To minimize utility plant cutbacks in production, spply more surface water for recharge to wellfields, and use ASR well for Floridan production. This option includes the following activities:

1. Investigate pumping from Palm Aire canals (instead of gravity flow) to accomplish a temporary interconnection of C-14 Canal and Prospect wellfield. Operate this interconnection to maximize recharge to Prospect wellfield, possibly by mounding water in Gator Lake
2. Increase yield of Ft. Lauderdale Prospect ASR well. Convert to production from Floridan, if not ASR operation. Examine chloride threshold for blending.
3. Increase recharge to Dixie wellfield by restoring and enhancing an interconnection between the wellfield and the C-12 Canal, and alter Old Plantation Water Control Districts operating regimen to deliver water eastward.

Implementation Time (Readiness) – Although a a contract already exists to connect the C-14 to Prospect via Palm Aire canals, the overground pumping of water to complete the interconnection faster would require immediate engineering assessment and cost estimate. (After analysis, it was deemed unfeasible to accelerate the existing project, since it would only achieve gravity flow and would not offer significant benefit in time for the 2001 dry season.) To achieve alternative ASR operation, immediate waiver of FDEP permit restrictions would have to be granted.. Improving the interconnection to the C-12 canal is estimated to be completed in time to achieve some benefit during the 2001 dry season.

Implementation Components -- Install the interconnection and deliver recharge water when excess water; overcome permitting issues (FDEP, WMD, Health Dept.). Operate ASR well to achieve desired targets. To accomplish recharge to the Dixie wellfield, need to:

- Refurbish the existing interconnection to the C-12 Canal by dredging approximately 2 feet of sediment, and removing vegetative overgrowth.
- Secure commitment for cooperation from the Old Plantation Water Control District.

Responsibility -- District has or is providing financial assistance to city of Ft. Lauderdale. County has already agreed to operate the interconnection structure. City operates and owns ASR well. The Turnpike Authority needs to give access to C-12 interconnect canal. Old Plantation Drainage District is responsible for its operating regimen.

Water Resource Benefits -- Protects against saltwater intrusion, while minimizing utility cutbacks.

Water Resource Impacts -- Prospect lake and wellfield is observed to drop to extreme low levels (sometimes in excess of – 20 feet NGVD). Recharge would benefit this lake and wellfield.

Water use Benefits -- Described above. Prospect recharge could achieve 5-MGD recharge benefit.

Cost -- Cost share between the city and District is already being implemented for gravity flow only (the District's share of the interconnection is $300,000). Costs would still need to be determined for installation of a temporary pump. The District contribution to the ASR well was $290,000. A cost estimate for supplying recharge water to the Dixie wellfield has not been completed. Other costs have been and will be borne by the City.

South County: Improve Integrated Operation of South County Regional System

Description -- Operational and infrastructure improvements would be made to the interconnected system serving several neighboring utilities. This option includes the following activities:

1. Increase Hollywood Utility Production by
   - Increasing finished water production from Floridan well
   - Increasing supply of reclaimed water to Orangebrook County Club for recharge benefit
   - Increasing production from Chaminade wellfield
2. Establish temporary interconnection/supply plan for County's 3A wellfield, Dania Beach, Hallandale Beach, and Hollywood
3. Increase raw water supply from County's Piccolo wellfield. To do so, resolve water quality problem, including sand separator installation. If additional production is successful, recharge the wellfield by one of two options:
   - using approximately 2000' of pipe to be installed, route water from C-11 Canal, through Embassy Lakes, and along Palm Ave. to Piccolo wellfield
   - Improve interconnection of existing secondary drainage canal S-18 to canal and lake adjacent to Piccolo wellfield

Implementation Time (Readiness) -- Increasing yield from Hollywood's Floridan plant is uncertain, but in progress and reportedly will be completed in time for the dry season. County's resolution of sand (water quality) problem form Piccolo wellfield is uncertain, though in progress and reportedly will be completed during the dry season. Negotiation of integrated plan for supply among South County utilities has been in progress for more than one year, though has been unsuccessful to date. Interconnection between C-11 and Piccolo wellfield has been investigated by most of the interested or affected parties, and could only be completed by March 2001 if it is fast-tracked. .

Implementation Components -- Hollywood must repair operational problems with Floridan well. County must repair raw water pipe from Piccolo to resolve sand problem. All parties would need to agree to interconnection . To interconnect C-11 with Piccolo, design, permitting and construction would have to be expedited. Permitting questions must be immediately answered before proceeding further.

Responsibility -- The involved utilities would need to agree to contingency plan. Hollywood, Hallandale Beach, Dania Beach, and Broward County would each carry out a portion of the integrated supply plan. The interconnection between C-11 and Piccolo would involve District, Cooper City, Central Broward Water Control District, and cooperation from Embassy Lakes and Royal Palm Ranches residential developments.

Water Resource Benefits -- Protects against saltwater intrusion, while minimizing utility cutbacks. The only apparent interconnection with District's regional system is to provide recharge to Piccolo wellfield from C-11 Canal. This recharge would benefit the Biscayne aquifer, a neighboring wetland system, and is expected to enhance flood control benefit for the Embassy Lakes residential development during high water conditions.

Water Resource Impacts -- Providing more water from an inland source such as Piccolo wellfield helps protect the coastal wellfields against saltwater intrusion, which has been observed in this system in the past.

Water use Benefits -- described above.

Cost -- Cities involved would bear most of the cost. District's costs would be related to facilitating agreement among south county utilities, and some of costs resulting from C-11 interconnection. County has proposed funding sand separator and is requesting financial participation from District. Rough estimate is $300,000. Rough estimate of one of the interconnection ideas between the C-11 canal and the Piccolo wellfield is $400,000 (presumably this would be shared by the County, District, and the Central Broward Water Contol District).

Additional Ideas:

1. Consider interconnection from Water Conservation Area 2B to the Springtree Wellfield operated by City of Sunrise. (central county)
2. Basic utility water shortage actions, such as interconnects with other utilities, pressure reduction, and conservation plans, etc. can be implemented. (countywide)

Conclusions

- This option has been divided into three general goals (North, Central, and South County), and 11 strategies.
- The goal for the North County is to use water from the Hillsboro Canal, as much as possible, to recharge the North County Regional Wellfield, and/or to coastal areas.
    - This action will help protect against saltwater intrusion, while minimizing coastal utility cutbacks. Some inland lowering of ground water levels could occur.
    - Some facilities needed to achieve this goal are complete. Others would need to be adapted.
- The goal for the Central County is to supply more surface water to wellfield and minimize utility plant cutbacks by using ASR well.
    - Achieving this goal will help protect against saltwater intrusion and minimize utility cutbacks. recharge would also benefit Prospect Lake and wellfield.
    - Structural components to implement this option could be completed if schedules are accelerated. Permit issues still need to be resolved
- The goal for the South County is to make operational and infrastructure improvements to the interconnected system serving several neighboring utilities.
    - This action would also protect against saltwater intrusion, while minimizing utility cutbacks. This recharge would benefit aquifer as well as neighboring wetland system.
    - A number of activities ar underway to achieve this goal, but will require substantial time to be completed. Planning and interconnection issues need to be resolved.
- Other options may be considered, including additional interconnections, pressure reductions and conservation plans

Option #16. S-47 A - D Operations

Description –Several agricultural projects utilize surface water from the C-19 canal under normal operation conditions. However, when the Lake Okeechobee levels drop, the conveyance capacity of C-19 declines to a point where (near 11' NGVD) all users can't get their permitted allocations. Under these conditions, water from the Caloosahatchee can be moved into the C-19 by opening the S-47-A through D structures and allowing the farmers to coordinate their pumping schedules.

Time Frame considerations –This option would need to be deployed when the Lake drops to +11' NGVD or less.

Implementation time – This option can be implemented with minimal lead time. The farm pumping protocol will be coordinated through water use permitting. Gates operations are maintained by the Clewiston Field Station.

Implementation Components – The Water Use Department will notify permit holders in the basin of the need to prepare to implement the water shortage alternative supply plan. Should the Lake level approach +11', Clewiston will be notified to open the S-47 structures.

Responsibility – Water Use Department and Clewiston Field Station field staff.

Water Resource Benefits – NA

Water resource Impacts – NA

Water Use Benefits – Avoidance of competition for insufficient water supply among users in the basin, potential financial losses and litigation.

Cost – The major cost for implementing this option is District staff time.

Conclusions --

- Movement of water into C-19, by opening the S-47-A and D structures, is an effective means to provide water to this canal when the Lake Okeechobee levels drop to 11 feet or below.
- This option can be implemented with minimal lead time by Clewiston Field Station field staff.
- Pumping activities by farmers in the basin need to be coordinated through appropriate planning efforts, the water use permitting process, or a water shortage order.

Option #17. Withhold STA Supplemental Water Deliveries

Description – This option involves the temporary suspension of supplemental water supply deliveries to cattail-dominated treatment cells of the STAs during water shortage conditions more severe than Phase 2 restrictions, in compliance with the Everglades Forever Act. During dry periods, water supply deliveries are generally made in order to maintain a minimum of six inches of water in the STAs. This level is needed to maintain the viability of the nutrient removal function, i.e., to keep the plants alive and to avoid exposure of the organic soil to oxidation that could lead to re-dissolving of the phosphorus when the area becomes wet again. Suspending supplemental water supply deliveries should **not** be considered an option for those treatment cells that are dominated by submerged aquatic vegetation (SAV), due to the potential for significant plant die-off and subsequent lengthy regrowth period. Currently, Cell 5 of STA-1W, Cell 3 of STA-2 and Cell 1B of STA-5 are SAV-dominated cells. During an extreme water shortage, these impacts on vegetation would have to be balanced against other needs within the region.

Time Frame Considerations – This option would be considered during the dry season under declared water shortage conditions more severe than Phase 2 restrictions. It would be of a short duration, until the lifting of declared water shortage conditions more severe than Phase 2 restrictions.

Implementation Time – This option is an operational based option that could be implemented rapidly and without the need for new infrastructure.

Implementation Components – STA operations would be modified to temporarily suspend supplemental water deliveries into the STAs upon activation of this option, consistent with the Everglades Forever Act. The Conceptual Design Document, developed under this act, requires the District to consider the water supply impacts of making these deliveries.

Responsibility – Operations Department is responsible for implementing this option and the Everglades Construction Project has responsibility to monitor and evaluate the STA response.

Water Resource Benefits – Preliminary estimates of the volumes of water that would otherwise be delivered to STA-1 West, STA-2, STA-5 and STA-6 (those operational this coming year) during drought conditions is approximately 25-35 thousand acre feet per year under conditions similar to the 1971 drought.

Water Resource Impacts – The principle risks associated with this option are as follows:

- the drying out and potential death of critical wetland vegetation;
- the potential flush of elevated nutrients from the STAs once flow-through operation resumes; and
- addition of nutrients to the water column through decomposition of plant biomass, especially SAV.

An ECP research project is looking at the effects of dryout on STA performance. The research has not been completed and the impacts are not completely known, however, evidence to date suggests that treatment cells populated with submerged aquatic vegetation (SAV) suffer a loss of plant life and elevated phosphorus levels upon commencement of flow-through operation. If the dryout is severe enough to kill a significant portion of the SAV, it may take from many months to a couple of years for the SAV to repopulate sufficiently to achieve a net improvement in phosphorus, i.e., to prevent the STA from being a source of phosphorus to the Everglades. During this ensuing vegetation grow-in period, the treatment cell may need to be taken off-line, which increases the likelihood of bypassing untreated phosphorus loads, and jeopardizing legal and regulatory requirements of STAs.

Water Use Benefits – See Water Resource Benefits above.

Cost – Operational cost are minimal. However, unexpected and significant costs associated with additional monitoring may result from the deployment of this option. In addition, depending upon the severity of the drought, there may be unexpected costs associated with massive revegetation of affected treatment cells. Also, if there are legal or regulatory violations due to poor performance of the STAs, there may be unexpected costs associated with enforcement actions.

Conclusions

- Temporary suspension of supplemental water supply deliveries to cattail-dominated treatment cells of the STAs during water shortage conditions could save 25-35 thousand acre feet per year under conditions similar to the 1971 drought.
- The principle risks associated with this option are damage to critical wetland vegetation; the potential flush of elevated nutrients once flow-through operations resume; and addition of nutrients to the water column through decomposition of plants.
- Suspending supplemental water supply deliveries should **not** be considered as an option for Cell 5 of STA-1W, Cell 3 of STA-2 and Cell 1B of STA-5 that are SAV-dominated cells.
- This is an operationally based option and could be implemented rapidly during the dry season under declared water shortage conditions more severe than Phase 2 restrictions.
- Operational cost are minimal but substantial additional monitoring costs may accrue as well as possible costs of revegetation of treatment cells and enforcement actions.

Option #18. Caloosahatchee River Salinity Control

Description –This option includes three potential actions that may be taken to reduce the occurrence of high salinity water upstream of the Franklin Lock and Dam: 1) Applying a Bubble Curtain, 2) Reducing the number of lockages, and 3) use of lower-level releases vs. higher-level water releases.

Bubble Curtain. In 1987 the Army Corps of Engineers constructed a two-inch PVC line across the east and west openings of the Olga Lock. The line had several holes drilled in it and was laid and weighted to the bottom of the river. Compressed air was then pumped into the line and allowed to escape through the drilled holes, creating a constant stream of bubbles rising to the water's surface forming a curtain or wall. The theory is that the curtain acts as a wall to keep the saltwater from encroaching to the eastern side of the lock. In 1990, the Corps removed the PVC because of constant problems such as blowouts and the pipe breaking, and replaced it with steel casing with the same design. The curtain was operated and maintained by the Corp during the dry months of the year. The District was advised that the curtain was operational through 1997. It is not currently operational, however the Corps has plans to have the bubble curtain status up and running in November 2000.

Reducing the Number of Lockages. Changes in the management of lockages was investigated in 1970 by the State of Florida, Department of Natural Resources, Bureau of Geology, Information Circular No. 62, Durward H. Boggess. (available at: http://www.sfwmd.gov/org/exo/cwmp/caloosdocs/index.html) . The report proposes three potential management schemes. Water Shortage Restrictions call for reduced lockages at Phase I restrictions and all

subsequent phases. The restrictions call for the District to coordinate with the Corp to restrict lockages to once every four hours if: a) chloride levels upstream of S-79 are 180 ppm or higher, and b) a rainfall in excess of one inch in 24 hours is not predicted in the surface water basin within the next 48 hours. If the restriction to once every four hours is insufficient to stop the rising chloride levels, the District shall request the Corps to further restrict lockages to once every four hours, twice per week. If the restrictions are still insufficient the District shall request the Corps to prohibit lockages.

Evaluate Possibility of Lower vs. Higher-Level Releases for Salinity Control. In the past, 3 to 4 day discharges from S-79 have been made to reduce salinity at the Lee County water plant during the dry season. The rate of discharge ranged from about 3,000 to 7,700 cfs per day. The total volume of these discharges ranged from 15,000 to 25,000 ac ft of water. Experimental releases from S-79 have been made to try and reduce the volume of water needed to flush the saltwater downstream and implement the discharges in a more environmental friendly manner. Results indicate that flows for 3 to 4 days are needed as follows: Day 1 – 1000 cfs, Day 2 – 2800 cfs, and Day 3 – 3100 cfs with Day 4 (2000 cfs) optional, depending on salt readings at the water plants. The total volume for the 3-day event is 13,800-acre feet.

Time Frame Considerations –

Bubble curtain – Corps has plans to have curtain up and running in November.

Reduced lockages – Immediate.

Salinity control releases - Implementation is 3 or 4 days.

Implementation Time –

Bubble curtain - The bubble curtain has historically been used during dry periods.

Reduced lockages – During low flow periods.

Salinity control releases - This option would be used during the dry season, most likely during April, May and beginning of June. This flush of saltwater needs to be conducted whenever the water supply is threatened by saltwater.

Implementation Components –

Bubble curtain - The viability of continued use of the curtain will need to be investigated.

Reduced lockages – Information Circular No. 62 proposes three options for reducing saltwater intrusion from boat lockages. They are: 1) Flushing of saltwater from lock chamber by controlled opening of the downstream gates and full opening of the upstream gates prior to lockage; 2) performing lockages on a scheduled time basis (for example to avoid lockages at high tide) rather than on signal, and 3) flushing of saltwater from the lock chamber during the lockages by opening of both upstream and downstream gates.

Salinity control releases - 1. Lee County Water Plant notifies the District and Corps of the problem. 2. The District requests the Corps to make specific discharges (as suggested above) to alleviate the problem. 3. Water plant monitors river water supply to determine if additional (4^{th} day) is necessary. 4. Continued monitoring by water plant to determine if the problem returns.

Responsibility –

Bubble curtain - Corps of Engineers.

Reduced lockages – Corps of Engineers once requested by the District per Water Shortage Restrictions.

Salinity control releases - District Operations.

Water Resource Benefits –

Bubble curtain - The effectiveness of the curtain has not been established. To our knowledge no monitoring or analysis was completed to determine if there is a water resource benefit. Lee County has indicated that during times that the curtain was activated they did not experience saltwater intrusion problems at their intake. It is suggested that a quantitative analysis be completed during the next dry season assuming that the curtain will be functional at that time.

Reduced lockages – Potential to reduce salinity releases from Lake Okeechobee.

Salinity control releases – Potential benefits include enhancement of estuary salinity conditions and protecting public water supply.

Water Resource Impacts –

Bubble curtain – No analysis has been completed, however it appears that there were no negative impacts during the time that the curtain was activated.

Reduced lockages – Potential to reduce salinity releases from Lake Okeechobee and prevent increases in chloride levels upstream.

Salinity control releases – This is a loss of about 14,000 acre feet of water from the lake for future water supply.

Water Use Benefits –

Bubble curtain – If it is determined that the use of the curtain results in reduced saltwater intrusion at the Lee County intake, no additional water treatment would be required.

Reduced lockages – Reduced lockages will reduce the extent of saltwater intrusion (high chloride levels) at the Lee County intake.

Salinity control releases - Protection of public water supply from saltwater contamination during the dry season. In the past, several discharge events were needed in one dry season to avoid contamination by saltwater.

Cost –

Bubble curtain –This information will have to be obtained from the Corps.

Reduced lockages – There would be an economic loss in the region due to reduced or prohibition of lockages. There would be no additional cost to the District or Corps.

Salinity control releases – District and Corps staff time using existing staff and infrastructure. No additional funds beyond normal operation cost would be needed.

Conclusions

- Use of the bubble curtain may provide protection against saltwater intrusion, but the benefits have not been adequately tested. The curtain is not currently operational, however the Corps intends to have it working in November 2000.
- Reduction of lockages is a standard practice to reduce saltwater movement upstream, but has adverse effects on the local economy due to reduction of boat traffic. An operational protocol is needed to determine the most effective combination of management options.
- When salinity levels upstream are too high, discharges of 3000 to 7000 cfs per day from Lake Okeechobee are used to flush saline water downstream. A large amount of water (14,000 ac-ft) is typically used during these releases. Alternative flow regimes should be investigated.

Option #19. Modify Caloosahatchee River Utility Treatment Technology

Description – Lee County utilities should transition to liquid chlorine or equivalent to allow use of more saline water from the river. At this time there are two utilities that withdraw water from the Caloosahatchee River (C-43) on the east side of the Olga Locks, the City of Ft. Myers and Lee County. The City of Ft. Myers pumps water from the Caloosahatchee to their well field located approximately ten miles to the south. The water floods a 543-acre project and is allowed to seep into the surficial aquifer and then is withdrawn utilizing screened Surficial Aquifer wells. Once withdrawn from the wells the water is then pumped to a membrane softening plant, disinfected with chlorine gas and distributed to their customers.

Lee County, on the other hand, has a water plant adjacent to the City of Ft. Myers withdrawal point on the river. The Lee County plant is an older plant uses airification methods to process the water and sodium hypochlorite (Liquid

Chlorine) to disinfect the treated water. Sodium hypochlorite is a salt, so when used, it will raise the level of chlorides within the processed product water.

Lee County depends on the District to maintain a fresh water supply on the east side of the Olga Locks because this plant has no way to reduce chlorides in the water. The maximum total chlorides that the County may utilize is 200 parts per million. This allows for additional chlorides that are added through the use of sodium hypochlorite.

The County stated that the Army Corps of Engineers has the Bubble Curtain at the Olga Locks, and with pulse releases from the District they are able to still utilize the Olga Plant. Lee County representatives are under the assumption that the screen is still under use during the winter, spring and early summer dry months.

The County has installed an Aquifer Storage and Recovery (ASR) well at the Olga Water Plant, and is in the early testing stages to find out its performance at this time. County representatives are under the impression that it would be at least three years at the earliest until they would be able to utilize the ASR well at the plant. They are depending on the minimum flows and levels plan proposed by the District, and the Bubble Curtain constructed by the Corps of Engineers, to reduce saltwater intrusion so that the Olga plant can operate in a drought period.

Conclusions.

- Further discussions with Lee County are needed to promote the transition to an alternative treatment technology.

Option #20. Water Conservation Projects -- Landscape Irrigation Retrofit and Education

Description – This option would focus on Districtwide implementation of landscape irrigation retrofit efforts. A pilot project to test this concept would be initially implemented in Lee and Collier counties. Partnerships would be established with local governments, utilities, irrigation contractors and suppliers to: replace ineffective sprinkler timers, reprogram timers, install rain switches, and calibrate (in cooperation with the Mobile Irrigation Labs) systems for maximum efficiency. Public education and cooperative advertising would be implemented with local governments, utilities, school districts, colleges, industry associations, homeowner groups, property managers, Soil and Water Conservation Districts and the Cooperative Extension Service and with local media. Cooperative funding for purchase of materials and services would be initiated through the allocation of incentive funds by the SFWMD.

Time Frame Considerations – Lee and Collier County efforts could begin now with currently budgeted funds. FY01 funding is anticipated through Water Conservation Incentive funds budgeted and prioritized in Water Supply Plans.

Implementation Time – Twelve to eighteen months.

Implementation Components – Planning, cooperative agreements, purchases of materials and services, public education, advertising.

Responsibility – District/ Local Governments/ Industry/ Media/ Educational Institutions.

Water Resource Benefits – Permanently reducing excessive landscape irrigation in areas with annual (spring) aquifer and utility demand problems could eliminate the need for declaring water shortage restrictions to protect the aquifers. This option results in both instilling a conservation ethic as well as installing conservation hardware.

Water resource Impacts – None.

Water Use Benefits – Better management of water levels in confined aquifers subject to annual drawdown by seasonal high demand for irrigation.

Cost – There will be a considerable cost associated with this option for the purchase of equipment, materials, services and advertising. Responsibility for these costs will be shared by the involved entities as well as those individuals/properties that receive the equipment, materials and services. District share should be limited to 50% of the program costs, with the remainder of costs to be provided by partnerships and in kind contributions.

Conclusions

- This option would focus on implementation of a landscape irrigation retrofit efforts, with initial emphasis on a pilot project in Lee and Collier counties.

- This option would be implemented through partnerships with local governments, utilities, irrigation contractors and suppliers.
- Implementation would require twelve to eighteen months, would permanently reduce excessive landscape irrigation, and result in better management of water levels in confined aquifers.
- This option may entail considerable costs for purchase of equipment, materials, services and advertising.

Option #21. Water Conservation Projects -- Year-Round Landscape Irrigation Guidelines.

Description – This option would focus on expansion of the existing, required Daytime (10-4/9-5) Landscape Irrigation Guidelines Ordinances. The proposal is to expand the practices to limit non-daytime landscape irrigation to 2 or 3 days per week. This option would reduce the existing demand for irrigation water by about 20-30% on a constant basis. The relative impact on water users would be minimal, especially compared to SWFWMD's one day per week permanent restrictions on landscape irrigation.

Time Frame Considerations – Start immediately to implement.

Implementation Time – Three to six months.

Implementation Components – Research whether the appropriate legal mechanism would be District Rule, Order, Special Permit Condition or local government ordinance.

Responsibility – District/ Local Governments.

Water Resource Benefits – Permanently reducing excess landscape irrigation in areas with annual (spring) aquifer and utility demand problems could eliminate the need to declare water shortage restrictions to protect the aquifers.

Water Resource Impacts – None.

Water Use Benefits – Better management of water levels in confined aquifers subject to annual drawdown by seasonal high demand for irrigation.

Cost – Minimal. Costs only associated with passage of Rules or Ordinances and for Public education efforts.

Conclusions

- This option would focus on the expansion of the existing, required Daytime (10-4/9-5) Landscape Irrigation Guidelines Ordinances.
- Implementation could begin immediately and be completed within three to six months, once an appropriate legal mechanism is determined.
- Implementation could permanently reduce excessive landscape irrigation and eliminate need for declaring water shortage restrictions to protect the aquifers.
- Costs are minimal, associated with passage of rules or ordinances and public education efforts

Option #22. Lake Okeechobee Stormwater Backpumping for Water Supply

Description – This option consists of back pumping stormwater and agricultural runoff from the Hillsboro, North New River and Miami Canals to Lake Okeechobee, using pump stations S-2 and S-3. A major concern requiring investigation is the ecological effects of early wet season backpumping on Lake Okeechobee that may be caused by high levels of phosphorus and turbidity

Historical Background: This option was a standard District mode of operation until July 1979. At that time, this practice was discontinued to reduce phosphorus loading to Lake Okeechobee. High phosphorus loads contributed to the frequency and duration of algal blooms, fish kills and other undesirable ecological impacts. Since 1979 significant back pumping to Lake Okeechobee for water supply purposes has occurred on three occasions:

- During the severe 1980-1982 drought, about 300,000 acre-feet of water was backpumped during August and September 1981 and 250,000 during the 1982 wet season.

- In 1985, when Lake Okeechobee stages were below 12.0 ft in June and July, water supply backpumping was again implemented and about 260,000 acre-feet of water was backpumped to the lake, primarily in the wet season.
- During the regional drought of 1988-90 water supply backpumping was implemented and approximately 125,000 acre-feet of water was backpumped to Lake Okeechobee during the wet season.

Water supply back pumping in the dry season is usually ineffective due to lack of rainfall during those periods. Only during the wet dry season of 1982, in which 160,000 acre-feet was backpumped, did this practice produce significant water supply benefits.

Time Frame Considerations – To achieve maximum water supply benefits, this option would be implemented during the wet season. See attached graphs for historical performance of this option.

Implementation Time – This option has been implemented before and facilities required for implementation are operational. Water quality and ecological concerns need to be addressed. A rigorous water quality sampling program will need to be activated. This option could be implemented in a relatively short time (one week).

Implementation Components – Facilities are operational and water quality monitoring equipment is already in place but additional resources in the Water Quality Department will be required. This practice has been used on an emergency basis during flood events or severe drought conditions.

Responsibility – This option will require Governing Board and FDEP approval. Operations will be in charge of operating the pumps using established criteria. Water Quality and the Lake Okeechobee Departments would monitor the ecological effects of this practice if this option were implemented.

Water Resource Benefits – Benefits, if any, appear to be insignificant.

Water Resource Impacts – This option can produce serious ecological impacts that could negatively impact the recently-observed benefits in the recovery of submerged plant communities in the littoral zone of the Lake.

The location of water inputs to the rim canal from S-2 and S-3 is very close to areas in South Bay where District staff are seeing the best recovery of submerged plant communities in the lake. The distance is short enough to expect that nutrient-rich, potentially turbid water will move from the rim canal into South Bay, since there are relatively deep boat cuts that lead directly from the rim canal to the submerged plant beds. This water could be pushed directly to the plant beds and negatively impact the environmental recovery that has already occurred.

Even if the backpumped water does not move into these areas, it likely would push rim canal water into the bay. Water in the rim canal has high color and high nutrient concentrations (as compared to very clear water with low nitrogen and phosphorus concentrations in the area where plants are recovering). Hence, this option may expose these vulnerable new plant beds to poor quality water, either directly or indirectly. Research conducted by District staff has shown that inputs of nutrients from EAA canal water can stimulate strong algae blooms under the existing clear water conditions at the south end of the lake during the summer months. Hence, even if the water to be backpumped has relatively few total suspended solids, it may trigger algae blooms, which would intercept sunlight before it reaches the submerged plants, and negatively impact these new plant beds.

Laboratory bioassays were conducted in September to determine the potential stimulatory or inhibitory impacts of canal water on lake biota. Algae, zooplankton, and juvenile fish were grown for 4 days in water and/or sediments collected from the EAA side of S-2 and S-3. There were no statistically significant impacts to any of the biota. However, historical data indicate that this water can contribute a significant amount of the phosphorus load to the lake. Efforts should be made to determine the best timing and location for backpumping and monitor impacts to minimize adverse environmental effects.

Water Use Benefits – Depending on the rainfall conditions in the Everglades Agricultural Area (EAA) during the upcoming dry season, the amount of water supply backpumping volume at S-2 and S-3 pump stations can vary significantly. Through modeling, the District staff made a preliminary estimate of about 70,000 ac. ft. of dry season backpumping volume under below normal rainfall condition in EAA. The resulting stage increase in Lake Okeechobee at the end of the dry season was estimated to be approximately one tenth of a foot. It appears that the backpumping volume during a dry season with below normal rainfall is not large enough to provide significant water supply benefits. The backpumping volume may increase significantly under normal or above normal rainfall conditions during the dry season. However, proposed changes to the Supply-Side Management Policy (allowing lake levels to drop below 11 before water shortage cutbacks begin) may reduce water shortage cutbacks significantly

under normal or above normal rainfall condition and the benefits of backpumping under such conditions during the dry season may be marginal. The entire water supply situation for Lake Okeechobee including the potential benefits of future backpumping needs to be investigated regularly throughout the dry season. The water supply benefits of backpumping during the wet season are much higher than during the dry season. Historical data included in this analysis provide an indication of potential wet season water supply benefits.

Cost – Estimated operation cost of the S-2 and S-3 pump station is $12/acre-feet being pumped, which will make the back pumping operational cost range from approximately $1.5 million, if volume pumped is similar to 1989-90 conditions, to $3.5 million if volume pumped is comparable to 1981-82 conditions. Cost of pumping S-6, S-7, and S-8 would be reduced. Additional cost will be required to monitor the water quality and ecological impacts of this option. Water quality monitoring equipment is in place for both pump stations since monitoring is required when emergency back pumping is performed. The estimated annual water quality monitoring cost is $50,000.

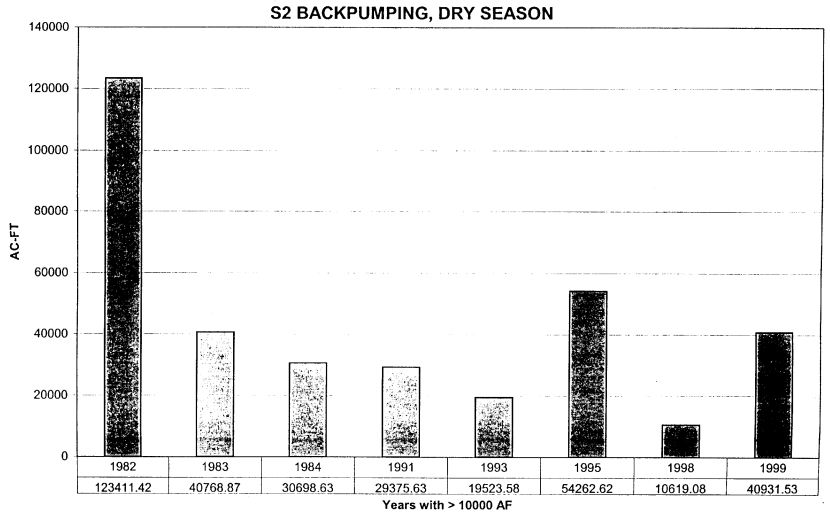
Conclusions

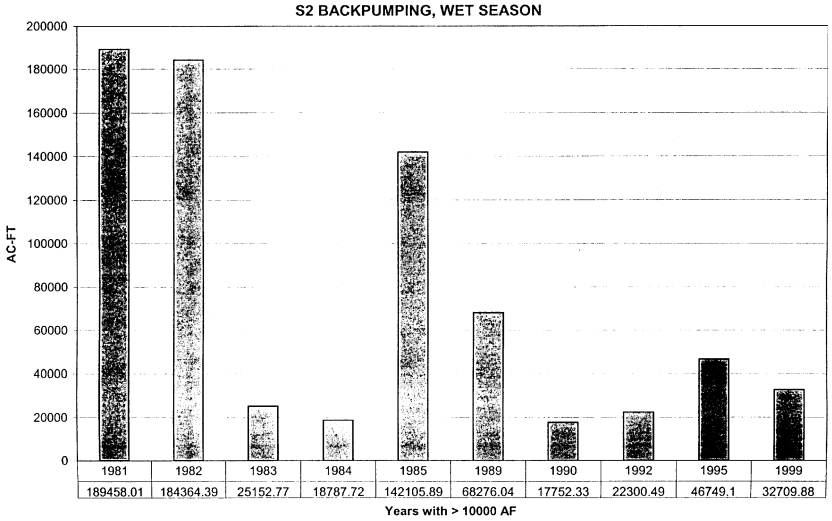
- Backpumping water from the Hillsboro, North New River and Miami Canals to Lake Okeechobee using pump stations S-2 and S-3 during wet periods can provide large amounts of additional water to the lake to delay the need for Supply Side Management and reduce the impacts of drought.
- Water supply benefits of backpumping during the dry season are significantly less then the benefits that accrue from backpumping during the wet season.
- Although backpumping was common practice for many years, it was discontinued (except during severe conditions) because it has serious ecological and water quality impacts.
- Alternative backpumping protocols should be investigated to determine regimes that will minimize environmental impacts and appropriate monitoring of Lake Okeechobee habitat and water quality should be implemented before backpumping is initiated

Table I-3. Summary of Backpumping Flows to Lake Okeechobee, 1980-1999.

Year	Dry Season Summary By Year (Nov-May)			Wet Season Summary By Year (Jun-Oct)			Annual Backpumping Summary		
	S2	**S3**	**S2+S3**	**S2**	**S3**	**S2+S3**	**S2**	**S3**	**S2+S3**
1980				6119.1	797.37	6916.47			
1981	0	0	0	189458	112964.3	302422.3	189458	112964.3	02422.3
1982	123411.4	35788.3	159199.7	184364.4	63295.48	247659.9	307775.8	99083.78	406859.6
1983	40768.87	23861.52	64630.39	25152.77	17825.73	42978.5	65921.64	41687.25	107608.9
1984	30698.63	8251.37	38950	18787.72	15017.09	33804.81	49486.35	23268.46	72754.81
1985	9623.94	11141.33	20765.27	142105.9	125162.9	267268.8	151729.8	136304.2	288034
1986	3485.01	0	3485.01	7656.31	5813.63	13469.94	11141.32	5813.63	16954.95
1987	856.87	0	856.87	733.89	497.86	1231.75	1590.76	497.86	2088.62
1988	8711.54	1846.64	10558.18	2037.06	0	2037.06	10748.6	1846.64	12595.24
1989	0	0	0	68276.04	55341 .65	123617.7	68276.04	55341.65	123617.7
1990	793.4	0	793.4	17752.33	993.73	18746.06	18545.73	993.73	19539.46
1991	29375.63	7463.91	36839.54	1908.12	1475.73	3383.85	31283.75	8939.64	40223.39
1992	0	448.27	448.27	22300.49	2074.73	24375.22	22300.49	2523	24823.49
1993	19523.58	3038.72	22562.3	2679.71	757.69	3437.4	22203.29	3796.41	25999.7
1994	624.8	483.97	1108.77	7908.23	2203.67	10111.9	8533.03	2687.64	11220.67
1995	54262.62	10581.98	64844.6	46749.1	20197.97	66947.07	101011.7	30779.95	131791.7
1996	390.16	2195.74	2585.9	5652.99	4811.98	10464.97	6043.15	7007.72	13050.87
1997	75.37	263.8	339.17	539.52	3314.44	3853.96	614.89	3578.24	4193.13
1998	10619.08	1067.13	11686.21	5401.08	372.9	5773.98	16020.16	1440.03	17460.19
1999	40931.53	21653.87	62585.4	32709.88	6411.64	39121.52	73641.41	28065.51	101706.9

Figure I-7. Backpumping Discharges to Lake Okeechobee from S-2





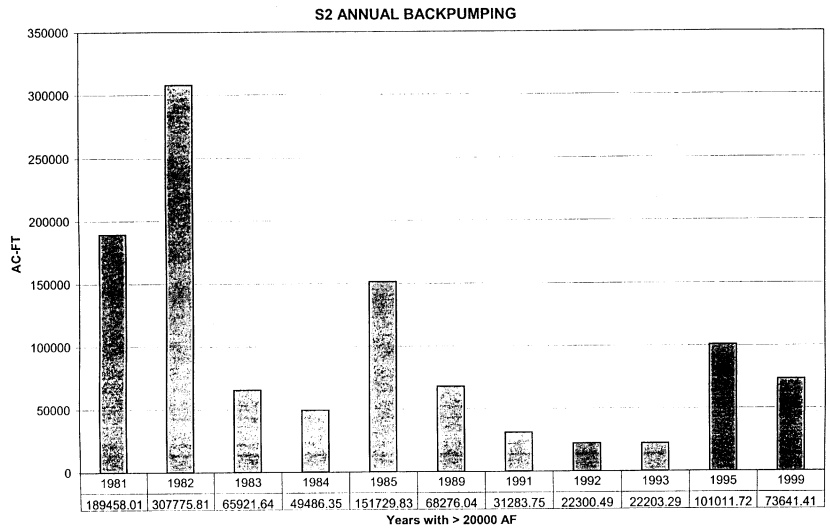
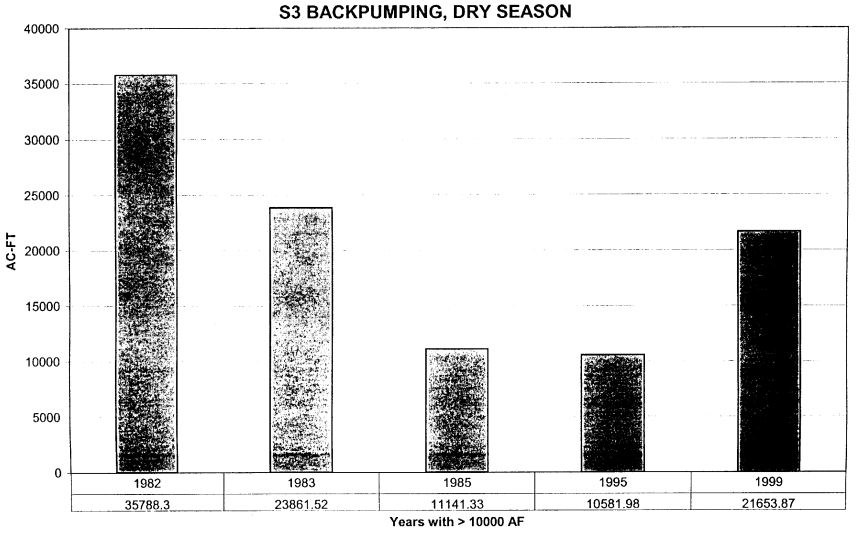
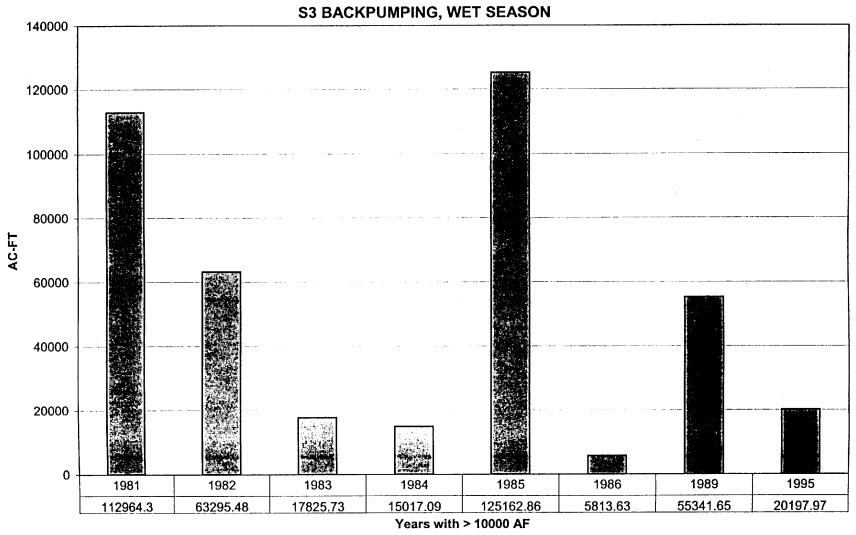


Figure 1-8 Backpumping Discharges to Lake Okeechobee from S-3





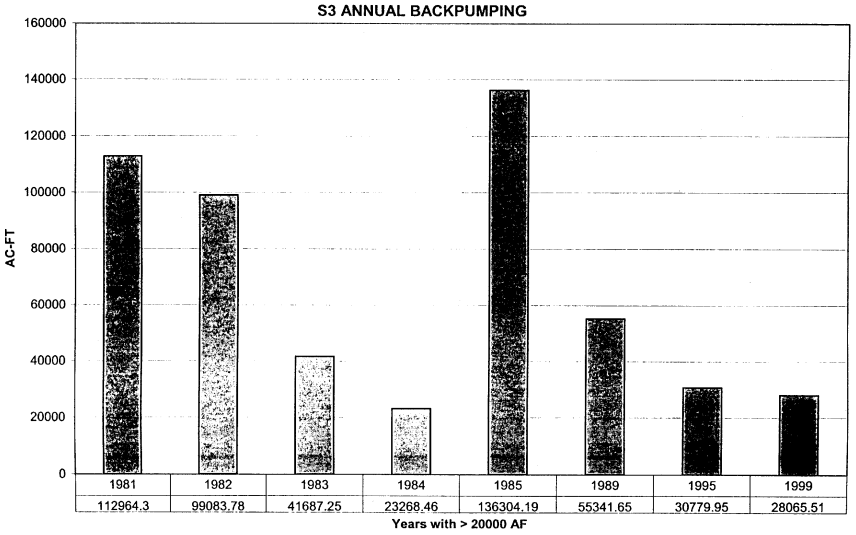
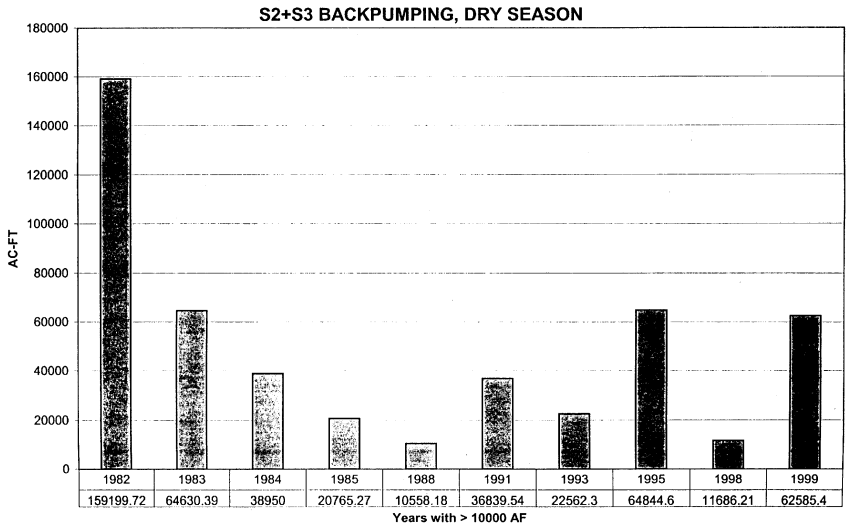
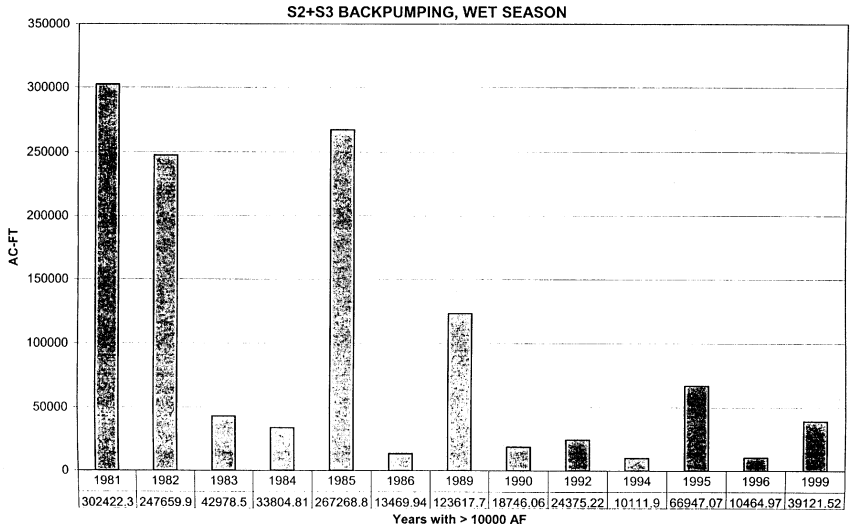


Figure 1-9. Backpumping Discharges to Lake Okeechobee from S-2 and S-3 Combined





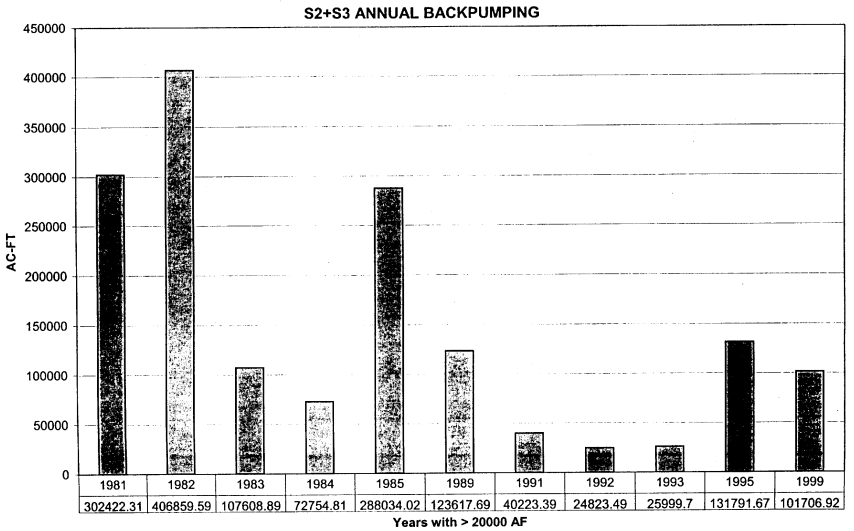
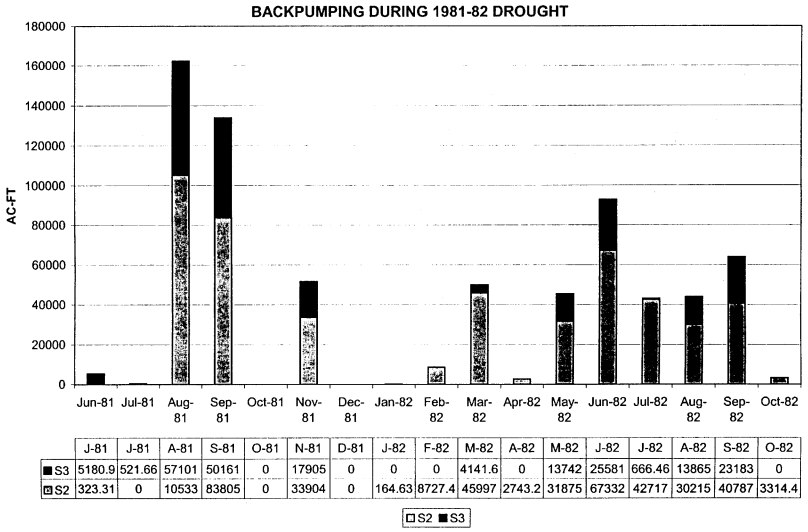
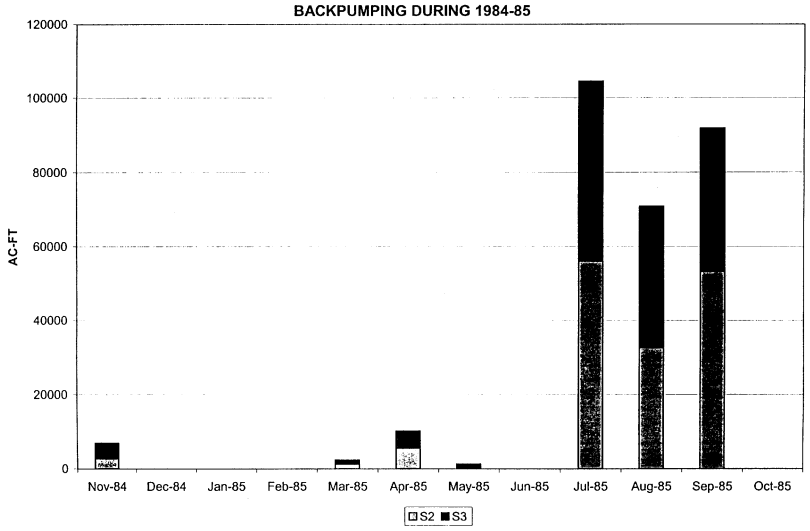
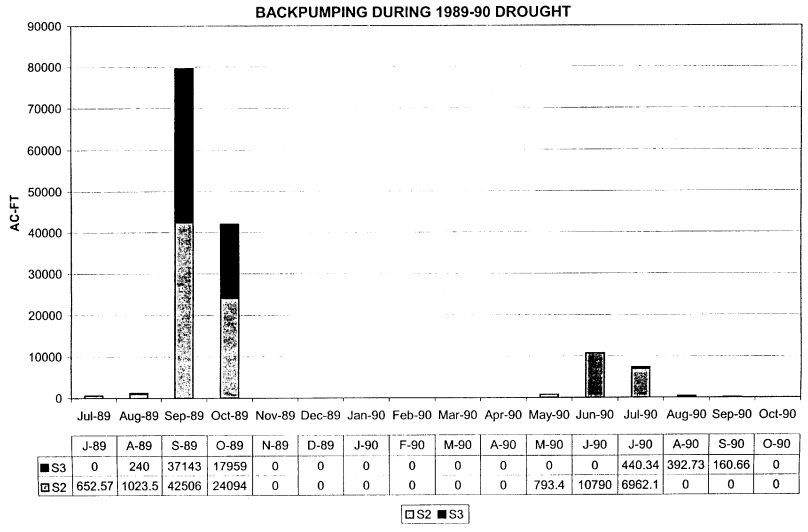


Figure I-10. Discharges to Lake Okeechobee during Historical Backpumping Periods



	J-81	J-81	A-81	S-81	O-81	N-81	D-81	J-82	F-82	M-82	A-82	M-82	J-82	J-82	A-82	S-82	O-82
S3	5180.9	521.66	57101	50161	0	17905	0	0	0	4141.6	0	13742	25581	666.46	13865	23183	0
S2	323.31	0	10533	83805	0	33904	0	164.63	8727.4	45997	2743.2	31875	67332	42717	30215	40787	3314.4





	J-89	A-89	S-89	O-89	N-89	D-89	J-90	F-90	M-90	A-90	M-90	J-90	J-90	A-90	S-90	O-90
S3	0	240	37143	17959	0	0	0	0	0	0	0	0	440.34	392.73	160.66	0
S2	652.57	1023.5	42506	24094	0	0	0	0	0	0	793.4	10790	6962.1	0	0	0

Option #23. Use Pumps at S-2 and S-3 in Reverse Direction

Description – Determine the feasibility of using S-2 and S-3 for pumping in reverse direction for backpumping water out of Lake Okeechobee when the lake is at low levels.

Implementation Components – The Physical configuration of the current pump, gearbox and engine could not pump in a reverse flow operation.

- The engine is a single rotation unit; the cranks, vertical drives as well as water and oil pumps would have to be changed along with other items.
- The gearbox was designed for a single rotation, the thrust bearing located in the base of the gearbox is designed for a downward load. The reverse rotation of the pump would create a negative load or lift which would result in catastrophic failure of the unit.
- The impeller of the pump would be on the opposite side of the discharge invert (suction in reverse)from the water we are hoping to move. The top of the discharge tube which would become the intake is at an elevation of 10 feet, which would not provide proper submergence without losing prime or cavitating.

The possibility does exist to install pumps across the spillway structures S-351 and S-3 54 located next to S-2 and S-3 respectively. It may be possible to locate 2-100 cfs pumps across a gate section provided the bridge would support the load and proper submergence can be achieved.

Cost Considerations –

Changing engine configuration and components would cost $300,000.

A new gearbox would cost an estimated $150,000

Rebuilding the station to establish proper configuration for intakes would cost $25,000,000-$30,000,000.

Implementation Time –

Time required to change the engine configuration and components is unknown

Changing the gearbox would require 6 months lead time for parts.

Conclusions

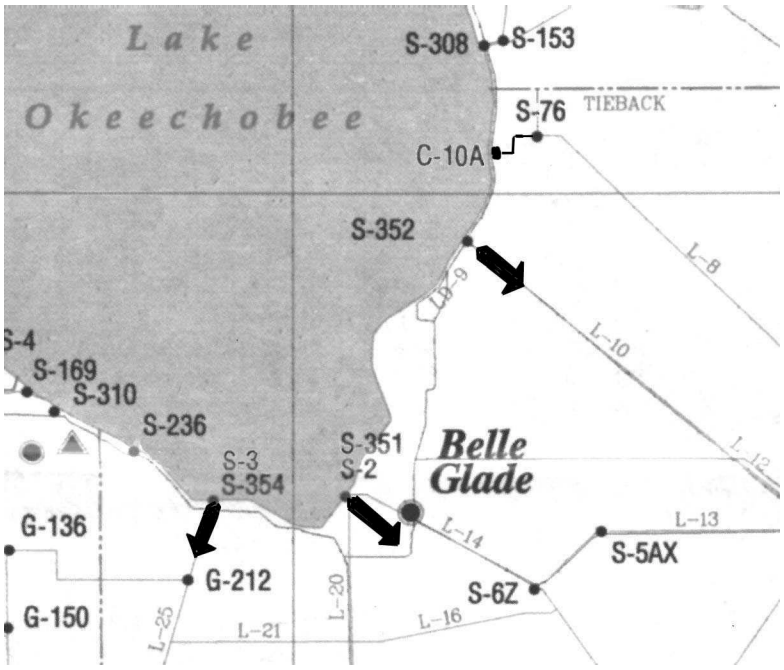
- Using S-2 and S-3 for pumping in reverse direction for pumping water out of Lake Okeechobee may increase the amount of water that could be obtained, but costs and lead time are substantial.
- Additional studies of this option could be considered in the District's long-term capital improvement planning effort.

Option #24. Capacity to Pump Water out of Lake Okeechobee at Low Lake Stages

Description – This option involves the construction of temporary pumping stations at key locations along the southern perimeter of Lake Okeechobee. The purpose of these facilities would be to provide adequate water supply quantity at appropriate supply canal levels when stages in Lake Okeechobee are below levels needed to facilitate gravity releases. Potential sites (see **Figure I-11**) include, but are not limited to the following:

- Retrofit existing water control structures S-351 with six 100-cfs electric submersible pumps, S-352 with four 100-cfs electric submersible pumps, and S-354 with four 100-cfs electric submersible pumps.
- Total combined capacity of the 14 pumps would be 1,400 cfs.

Figure I-11. Potential Locations of Pumping Facilities



Time Frame Considerations and Implementation Components – Elements of this option are major physical facilities that may require conceptual design, hydrologic and hydraulic analyses, engineering design and construction. Projects of this size and complexity typically take several years to design and construct. However, the U.S. Army Corps of Engineers recently constructed a temporary 500 cfs pumping station and impoundment in southern Miami-Dade County in less than six months for a cost of approximately $6 million. A proposed list of activities and schedule for accelerated implementation during the next 6 months is shown in **Table I-4.**

Table I-4 Project Schedule

Task	Completion Date
Equipment/installation proposal	9/18/00
Negotiate equipment contract	9/20/00
Preliminary engineering report	9/21/00
Waiver justification	9/21/00
FP&L letter of intent	9/22/00
Execute waiver of competition	9/22/00
Execute equipment contract	9/22/00
NTP to equipment contractor	9/25/00
Final engineering report/implementation plan	10/05/00
Delivery (2) at each site pumps S351, S352, S354	12/15/00
Install pumps at sites S351 S352, S354	12/20/00
Fuel tank lease	12/01/00
Fuel tank delivery and install S352	12/10/00
Delivery (4) pumps S351	1/15/00
Install (4) pumps S351	1/25/00
Delivery (2) pumps S352	1/31/00
Install (2) pumps 5352	2/05/00
Delivery (2) pumps S354	2/15/01
Install (2) pumps S354	2/25/01
End of operation	6/30/01
Removal	7/15/01

Responsibility –Engineering and Land Management Division for the preparation of engineering designs and construction documents. Environmental Monitoring and Assessment Division for monitoring and water quality

assessment. Operations Control Division for modified water control operations and coordination with the USACE on operational issues. Watershed Planning and Research Division and Office of Counsel for coordination with FDEP and other stakeholders. Cooperation from, and coordination with, local agricultural interest, Special Taxing Districts and utilities may be required to successfully implement this option.

Water Resource Benefits – The assurance of a reliable source of water under dry conditions during periods of low lake levels, would lessen the threat of economic impacts to urban and agricultural interests. This would potentially increase the flexibility available to manage Lake Okeechobee at lower levels to benefit the littoral zone and reduce impacts to the estuaries resulting from Lake Okeechobee regulatory discharges.

Water Resource Impacts – Impacts to Lake Okeechobee include reduction/loss of navigability and recreational use, adverse effects on littoral zone and benthic plant and animal communities and fisheries, and increased potential for violating Minimum Flows and Levels Criteria.

Water Use Benefits – See discussion above.

Cost – Estimated Costs for implementation of this option above normal operating expenses are summarized in **Table I-5**.

Table I-5. Cost Estimates to Pump Water out of Lake Okeechobee at Low Lake Stages

Item description	Quantity/ unit	total cost for site		
		S351	S352	S354
Pump unit	4/job	472,993	472,933	472,993
Bulkhead	2/job	65,000	65,000	65000
Electrical and Control Systems	LS/job	43,649	43,649	43,649
Generator rental	6/mn		45,000	
Install units	LS/job	10,000	10,000	10,000
Fuel tank rental	LS/job		3,000	
Removal	LS/job	10,000	10,000	10,000
Total:		**601,642**	**649,582**	**601,642**

Conclusions:

- Construction of temporary pumping stations at key locations along the southern perimeter of Lake Okeechobee may provide additional water when stages in Lake Okeechobee are too low to allow gravity releases.
- Impacts on navigability, recreational use, biological communities may occur as well as increased potential to violate Minimum Flows and Levels criteria.
- These facilities would also potentially increase the ability to manage Lake Okeechobee at lower levels to benefit the littoral zone and reduce impacts to the estuaries resulting from regulatory discharges.
- Three sites, with a combined pumping capacity of 1,400 cfs, are under consideration.
- Costs are estimated at $1 million - $2 million. Tthese facilities could be built within 6 months under an accelerated construction program.

Option #25. Comprehensive Water Conservation Education Campaign

Description – At the September Governing Board's direction, the District will initiate a comprehensive Water Conservation Education campaign to assist water users in reducing water use during the warning period. This campaign will focus on education and outreach on all water use types and to all the water users. Landscape, commercial, agricultural and industrial water use will be focused upon in the campaign. The goal is to assist in an effort to reduce current water demand, initially by 10%.

Time Frame Considerations – Start immediately to implement

Implementation time – Six months to one year

Implementation Components – Inventory existing media products, update and upgrade in-house, initiate leveraged media placement of products, compliment with Service Center Outreach staff, re-visit existing contracts for message inclusion.

Responsibility – District/ Local Governments/ Utilities/ Water Users

Water Resource Benefits – Reducing excessive utility and agricultural demand could eliminate, delay or lessen the need for declaring water shortage restrictions to protect the aquifers and surface sources of water supply.

Water resource Impacts – none

Water Use Benefits – Better management of water levels in surface waters and aquifers subject to annual drawdown by seasonal high demands.

Cost – $300,000 - $500,000 ($296,000 authorized from FY2000 contingency funds) for Public education efforts, creative production, media placement of messages, outreach efforts. Project will seek to leverage District funds through in-kind and financial partnerships.

Conclusions

- The District will immediately initiate a comprehensive Water Conservation Education campaign to help reduce landscape, commercial, agricultural and industrial water demand, initially by 10%.
- Reducing excessive demands could reduce the need for water shortage restrictions
- Estimated Cost is $300,000 - $500,000.

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SFWMD, 2000b. *Caloosahatchee Water Management Pla*n. Water Supply Department, Water Resources Management, South Florida Water Management District, West Palm Beach, FL.

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